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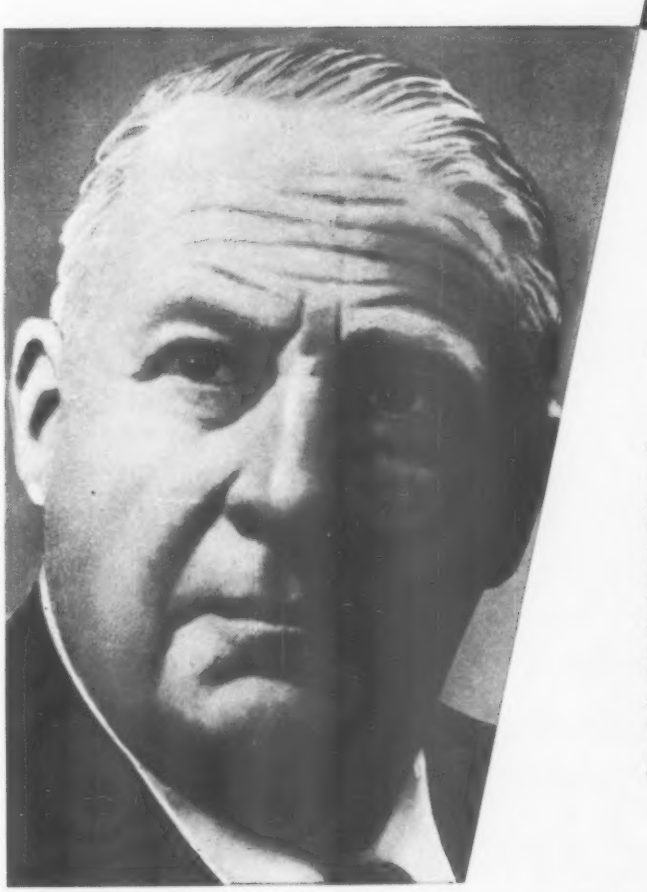

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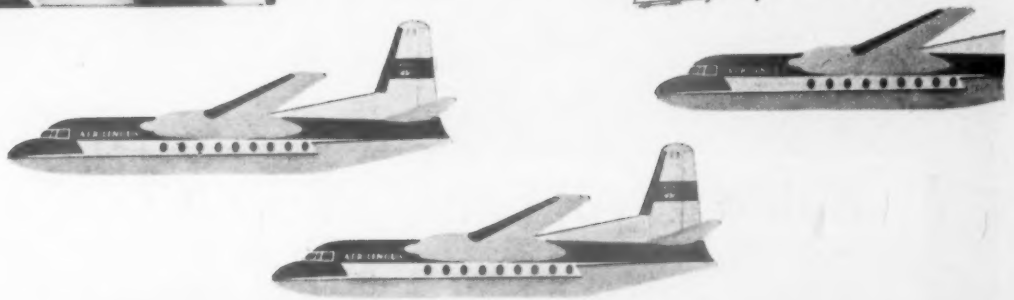

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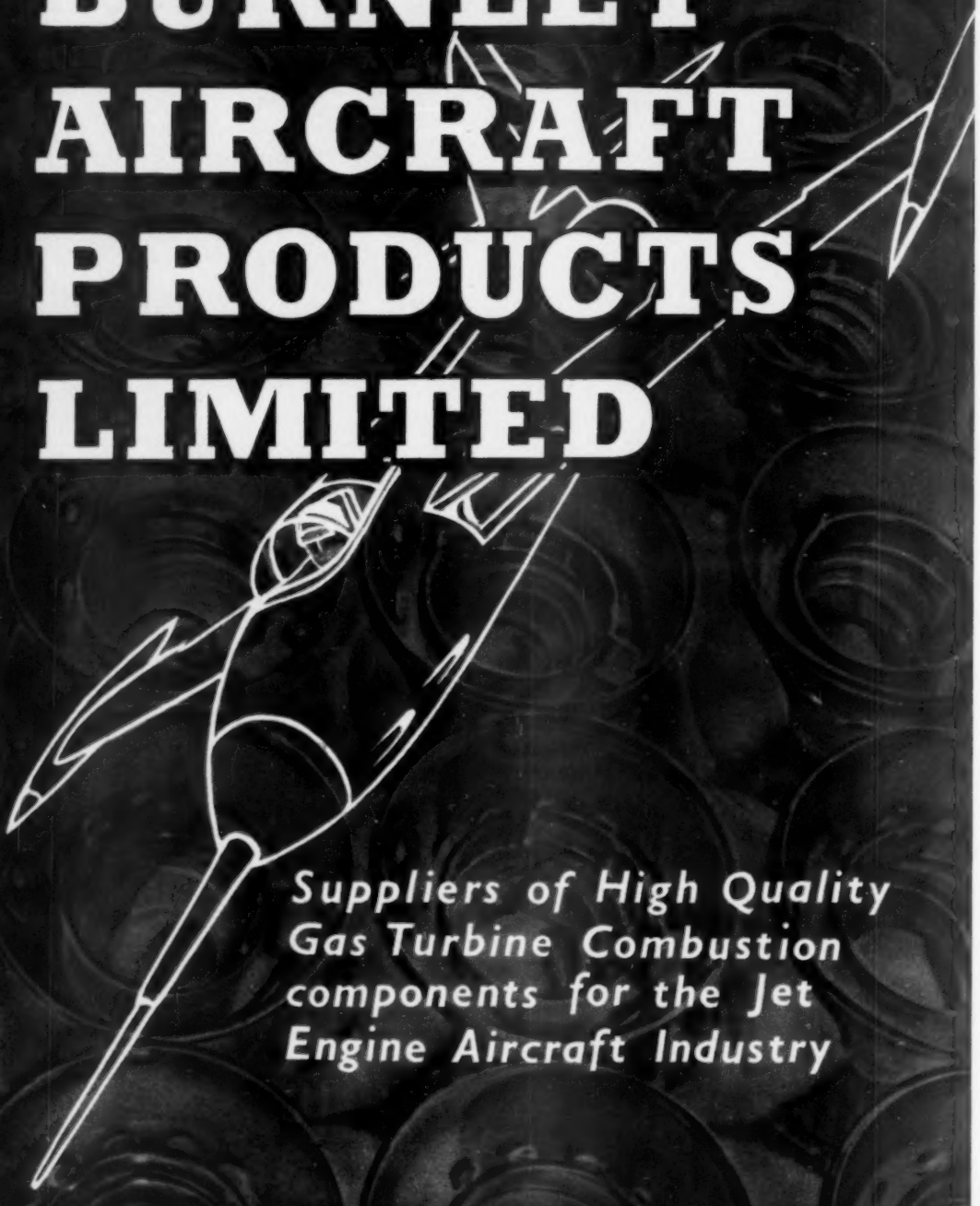

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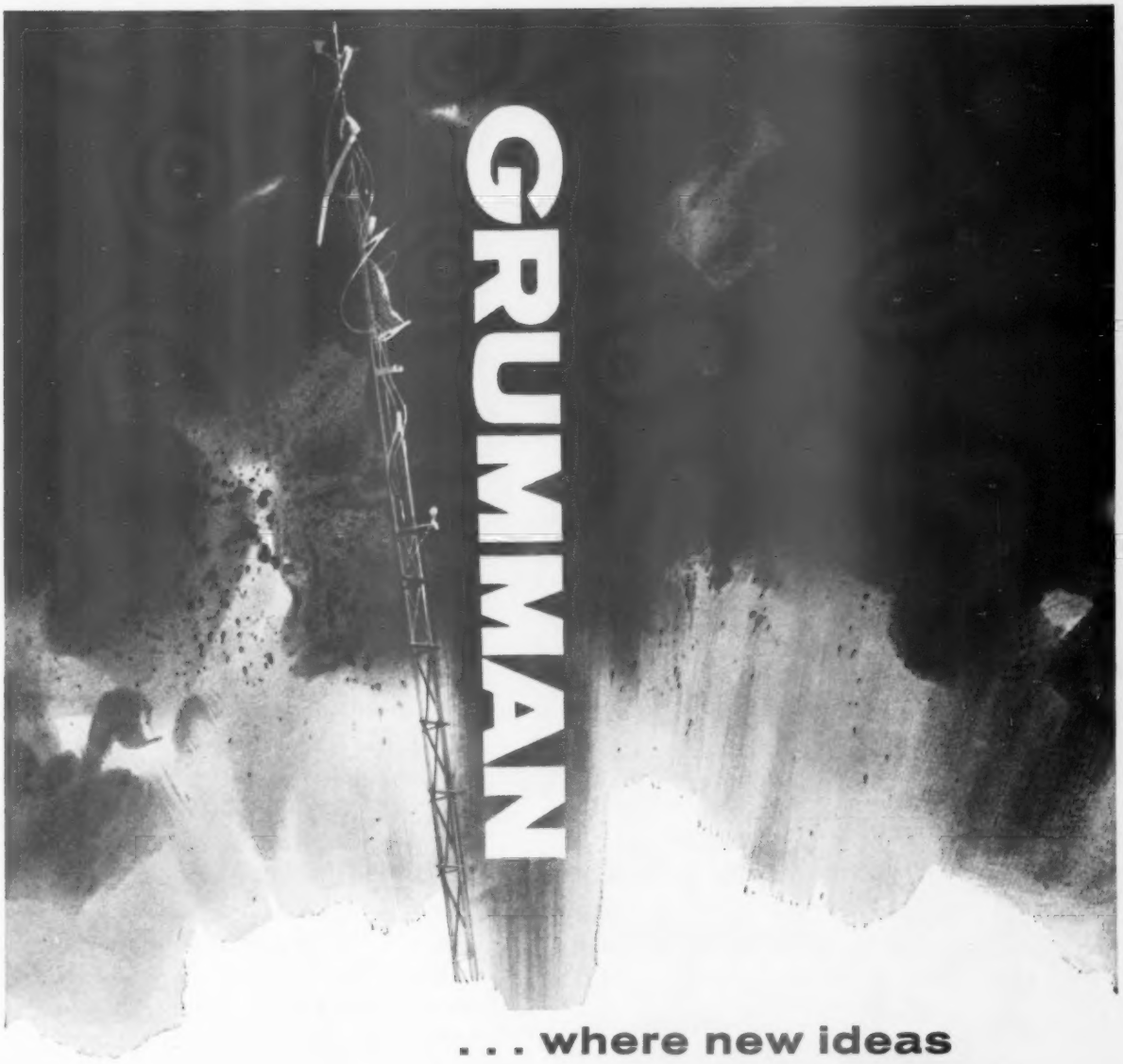

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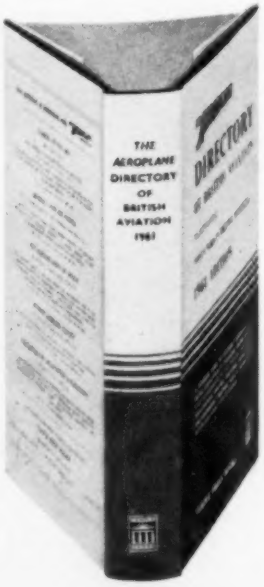

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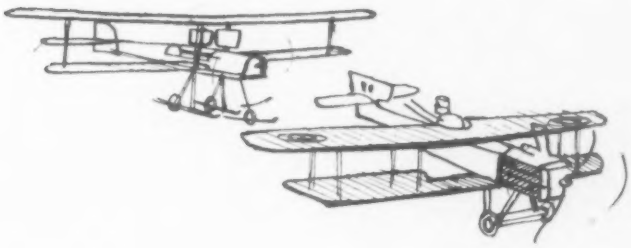

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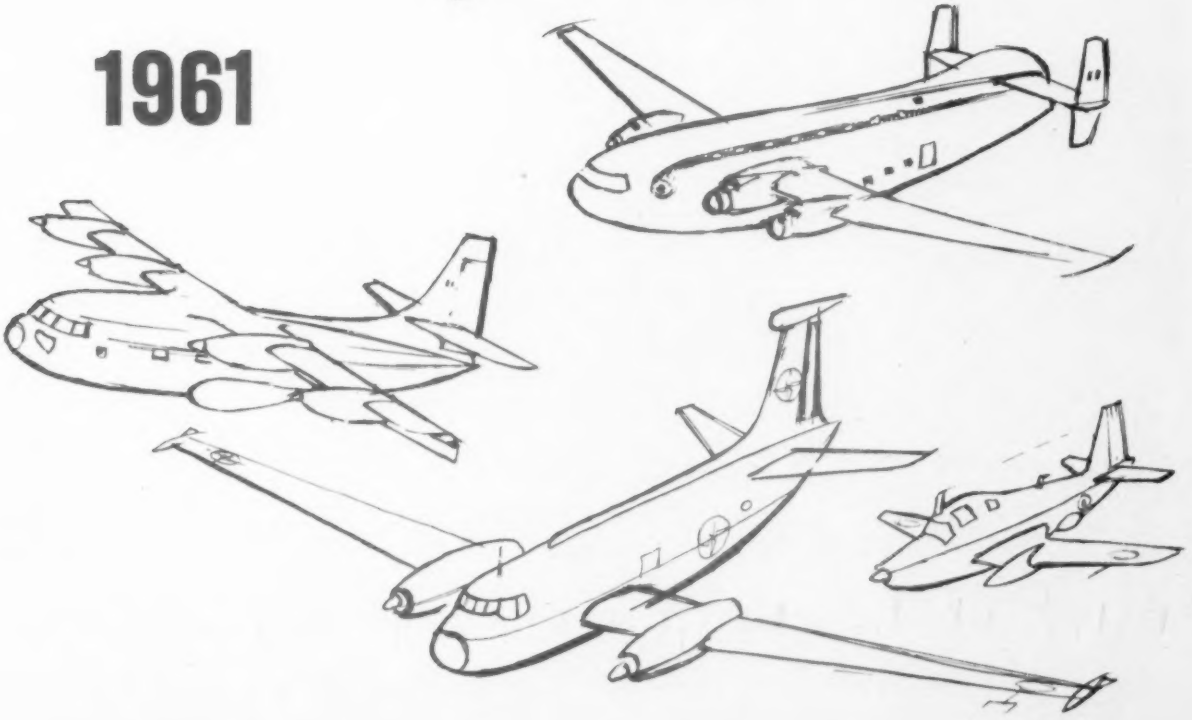

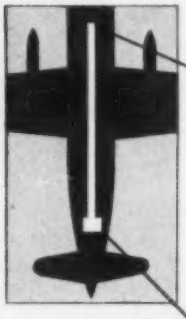

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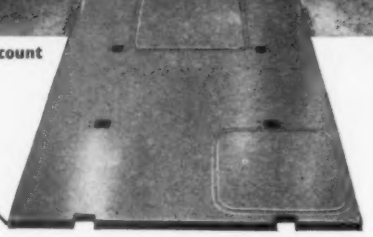

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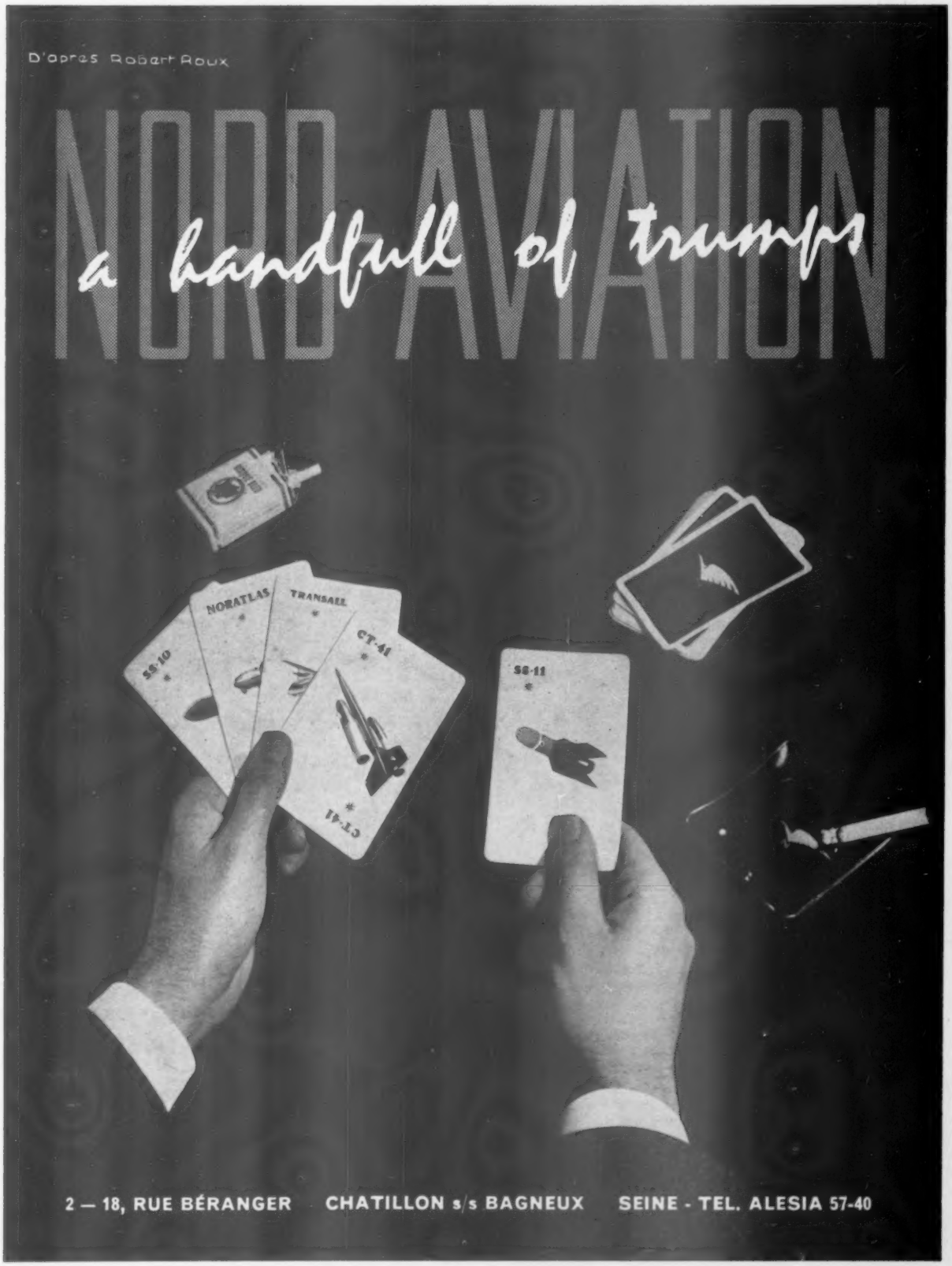

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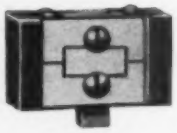

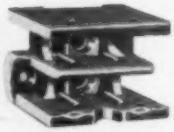

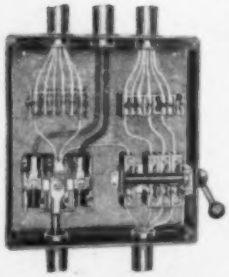

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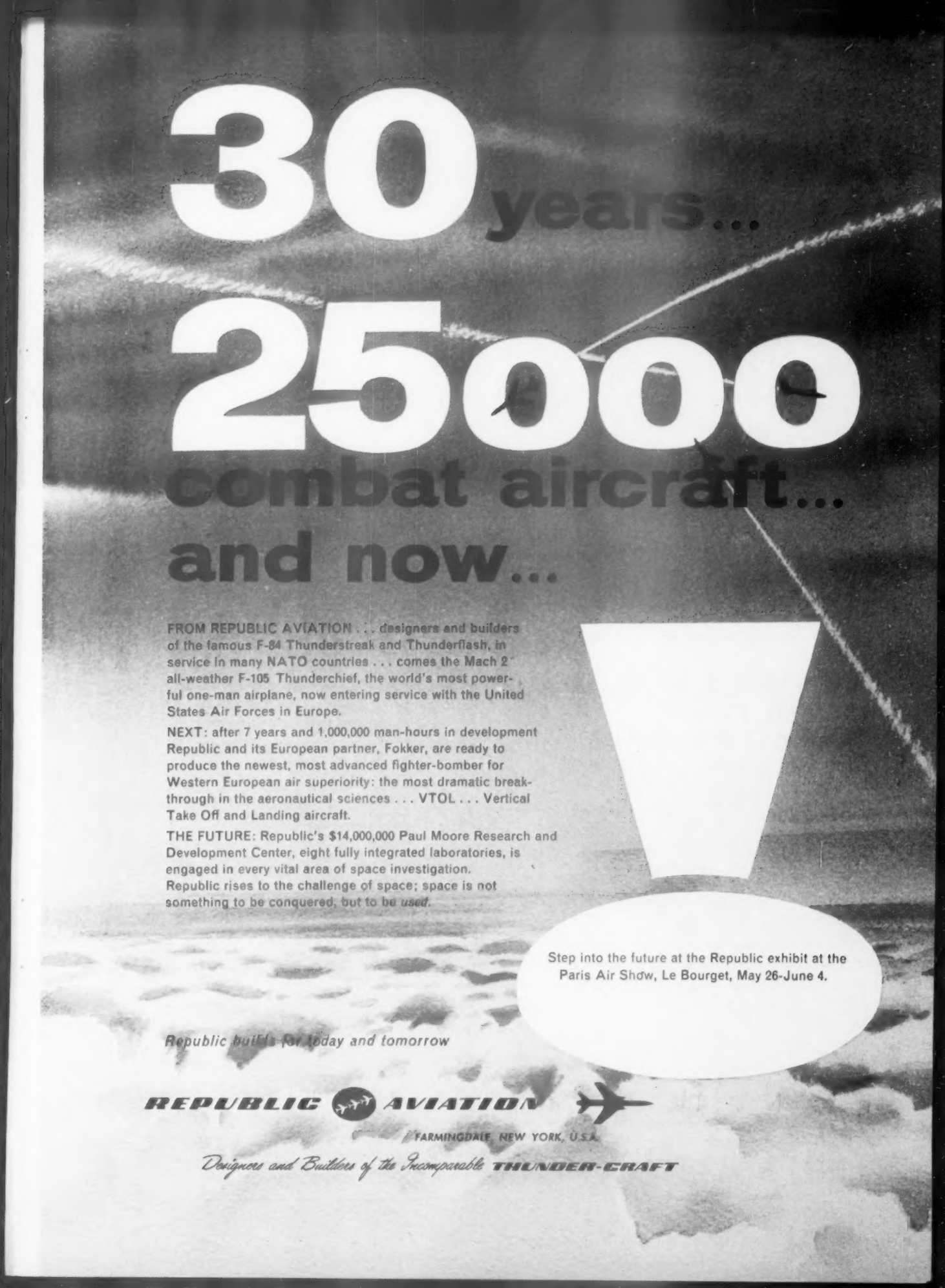
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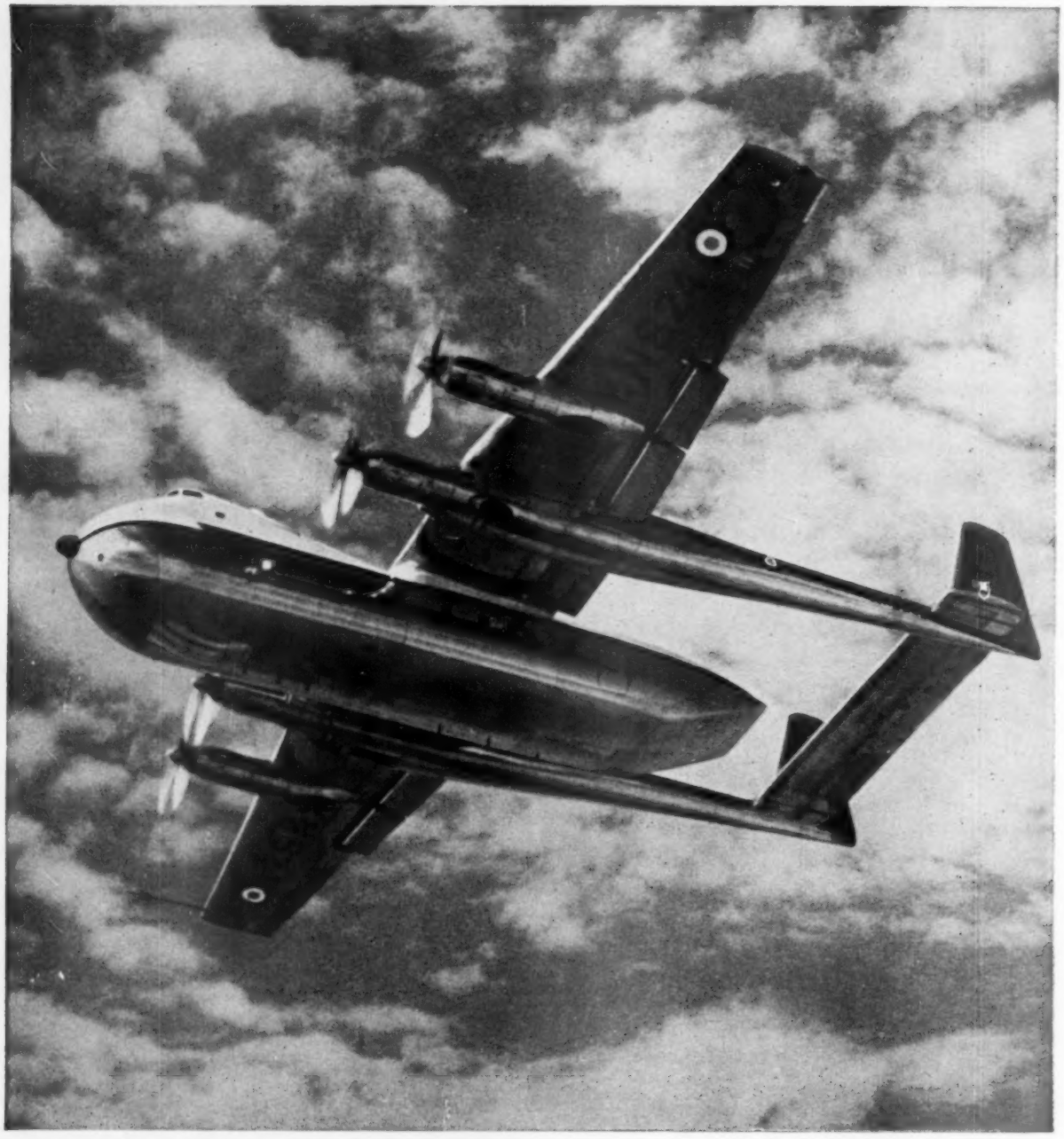

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THE AEROPLANE and ASTRONAUTICS

VOLUME 100 NUMBER 2588 MAY 25, 1961

Le Bourget Cogitations

Amid the skirling of the pipers, that essential Scots concomitant of any British undertaking involving public spectacle these days, the British Exhibition has opened in Moscow. British businessmen have every hope of selling British goods on the Russian domestic market. It has yet to be made clear what we are going to get in return for the roubles earned: no doubt, the United Kingdom can absorb a good deal of fish, vodka and timber.

However, while that Exhibition is in being the Russians have announced their intention of sending along three different commercial aircraft types to the Paris Air Show. Here is a field where Russian exports are doing a growing business. This began as a natural extension to the work of Aeroflot, the Soviet's own great airline, with the supply of Russian aircraft to the satellite countries. But with the creation of new countries in the Old World, Russian aircraft are finding their way to a much wider market. It must not be overlooked that one of the Russian exhibits to be at Paris is powered with turbo-fan engines. As competitors therefore in World markets the Russians must not be underrated.

Coinciding with the opening of the Paris Aero Show comes news of the decision of the Australian Government to have Atar engines in the Mirage III fighters ordered for the Royal Australian Air Force. There will be many congratulations to our French friends on this double success of their aircraft industry. There will also be many expressions of condolence for Rolls-Royce; this internationally regarded builder of aero-engines was widely assessed as having an excellent chance of selling their Avon turbine for the order in view of the considerably enhanced performance which its installation conferred.

The placing of the order is indeed a sign of the times. Today, the aircraft industries of the World can no longer count on aircraft being ordered by their own governments and developed for their own air forces to become available for production and sale in the export market. That such orders can be obtained is shown by the successful sales of the Mirage and the F-104. Equally, the most success may go to those who have risked all on a private venture. It is the excessive cost of the last-mentioned which has led to so much wide-scale grouping and collaboration in the international aircraft business.

The French industry has made such progress that its products are to be seen in the air in military and civil fleets around the World. Indeed it may be said that if the New World were once brought in to redress the balance of the Old, today the New World has realized the importance of coming back to the Old World to invest in Europe —and in NATO. There is hidden as well as overt U.S. participation at Le Bourget.

Thus in 1961 the Paris Aero Show has become a truly international occasion. Naturally the organizing body, supported as it is by an ebullient industry, has made sure that the occasion will form a fitting shop window for French aircraft and equipment. Nevertheless, the shop window will be used to show the finest aeronautical products of Western and Eastern Europe as well as many from North America. The British industry is being worthily represented for the occasion.

The French Aero Show is one to which we must all wish every success. The widespread participation there is a reminder of the strong competition which the exhibitors at our own Farnborough have so successfully contested in the past, as they certainly will in the future.

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Matters of Moment

Atar-Mirage for Australia

THE Australian Minister for Air, Senator Wade, announced last week in Canberra that the French SNECMA Atar engine had been recommended for the R.A.A.F. Dassault Mirage IIIs, after technical assessment in France. When the Australian Government agreed to buy the Mirage from France, the choice between the Atar or a Rolls-Royce Avon Mk. 67 as powerplant was left to the findings of an R.A.A.F. mission in Paris, which has been evaluating the merits of the standard IIIC aircraft against the experimental Avon-engined IIIO.

Several flights have been made in the Mirage IIIO by Wg. Cdr. Rowland of the R.A.A.F. test team, and this prototype is now to revert to Atar power. It is therefore to be withdrawn from exhibition at the forthcoming Paris Aero Show. During extensive flight tests, the Mirage IIIO showed excellent handling qualities and improved performance from the greater thrust of the Avon, particularly at low altitudes.

It is reported that a development of the Atar engine, the 9K, which is being tested by the French Air Force, is being considered by the R.A.A.F. as an alternative to the Atar 9C fitted to the Mirage IIIE ground-attack version. The Atar is to be manufactured to a substantial extent in Australia by the Commonwealth Aircraft Corporation, which is also to make airframe components of the Mirage, including wings and fins.

Blue Streak Versus American Launchers

THERE have been further repercussions to the offer made in Oslo on May 8 by Mr. Dean Rusk concerning American-built missile launchers for a European Space Programme. As reported in our May 18 issue Sir Robert Renwick, chairman of the newly formed British Space Development Company, at once saw in it the long arm of big business extended to keep Britain out of the field of commercial space exploitation; and questions which followed in Parliament—both to the Prime Minister and to the Minister of Aviation—sprang from the same apprehension. They are reported on p. 574.

In a broadcast interview on May 9, Mr. Thorneycroft emphasized that the American offer was made purely for the purposes of scientific research in space. Blue Streak, on the other hand, would be available for both scientific and commercial purposes, and he particularly stressed the importance of launching communication satellites. "We are in the Space Age," he said firmly. "For the countries of Europe to drop completely out of this and become entirely dependent on someone else is a very big decision. We are going to co-operate with the United States—we are very good friends—but we do not want to be entirely dependent, and that is why the British and French have made this offer."

Although some European countries whose interests do not extend beyond pure space research may consider the American proposal tempting, Britain and France in particular are anxious to proceed with a European rocket. The importance of retaining the capacity to build large rockets, and the technological experience stemming from such activity, are now more widely appreciated. And, if commercial and military opportunities exist in space-development—as they obviously do—it is important that we are not vulnerable as regards the supply, or lack of supply, of suitable boosters.

There would obviously be very strong opposition from commercial interests in America to a proposal for Britain to use American facilities and vehicles to launch competitive communication satellites, for example, and this is only one of a number of reasons why it would be illogical to rely exclusively on U.S. launchers. Even if satisfactory arrangements were made for launching certain non-scientific satellites in the United States, how could we guarantee the right priorities to launch them from American ranges which are already overburdened by national military and space-vehicle schedules?

Photograph copyright "The Aeroplane and Astronautics"

PRESIDENTIAL SEAT.—Sir Roy Fedden (right), a distinguished past president of the Royal Aeronautical Society, formally presents to Dr. E. S. Moult a handsome presidential chair for use in the new R.Ae.S. lecture hall. Dr. Moult was president of the Society when the hall was opened.

Pressure Suit Developments

VERY high-altitude operation of aircraft has brought with it a number of associated problems—not the least of which relates to the protection of the crew and other occupants against the effect of sudden decompression. This is particularly important in the case of military aircraft which not only have to fly at extreme altitudes—such as those now being regarded as commonplace for the new generation of V-bombers—but also are prone to structural damage through hostile action. Indeed, it is customary for the R.A.F.'s Vulcans and Victors, for example, to be flown at a much reduced cabin differential during high-level "operational" sorties in order to mitigate any likely decompression effects.

In parallel with the development of these high-altitude aircraft, then, a good deal of attention has been directed towards the development of pressure suits for the crew which give full protection and, at the same time, allow comfortable and adequate freedom of movement. New plastics materials have done much to help in this direction.

BLUE WATER.—This new English Electric surface-to surface tactical missile is a Corporal replacement. Here, the guidance computer vehicle is on the left; the theodolite is used to align the stabilized platform of the missile's inertial guidance system. Blue Water can be fired 10 min. after receipt of the target's position.

Photograph copyright "The Aeroplane and Astronautics"

There is, in fact, a continuous programme of research into various aspects of this problem at the R.A.F. Institute of Aviation Medicine at Farnborough. During a visit to the institute last year some of this work was to be seen (THE AEROPLANE AND ASTRONAUTICS, Sept. 30, 1960) in progress with British equipment.

A particularly interesting recent development in this continual process of development is, we understand, the evaluation at Farnborough of an American suit similar to that used by Cdr. Shepard in his Mercury capsule space-flight. This suit, it appears, is the subject of a licence agreement between the American company of B. F. Goodrich and BTR Industries, Ltd., in this country, whereby it can be manufactured in the U.K. if required. Presumably both the BTR member companies, Microcell, Ltd., and Palmer Aero Products, would contribute their separate specialist skills to such production.

At present, though, this particular project appears to be in an early stage and much will depend upon the result of the evaluation of this and other pressure suits, as to which will be chosen for equipping V-bomber crews in the future. The Goodrich suit has, incidentally, already been flown by BTR in a Canberra with the navigator pressurized in it to 3½ p.s.i. differential.

Joining the Hawker Siddeley Board

RELINQUISHING his position as joint managing director of Blackburn Aircraft and his directorships of other Blackburn companies, Mr. N. E. Rowe is joining the board of Hawker Siddeley Aviation and taking up a new appointment in which he will work with Mr. S. D. Davies, the company's technical director (aircraft). Mr. Rowe takes to this post a wealth of experience in aeronautical engineering and a wide understanding of the problems involved in the aviation technologies; no doubt his long specialization in research and development matters will be put to very good use in his new duties. He was president of the Royal Aeronautical Society for 1955-56 and is a member of the Aeronautical Research Council and of the Air Registration Board.

Avro's New Chief Engineer

FOLLOWING a brief report last week that Mr. J. R. Ewans, A.C.G.I., B.Sc., D.I.C., F.R.Ae.S., was resigning from his appointment as chief designer of A. V. Roe, it has now been disclosed that Mr. M. J. Brennan, B.Sc., M.I.Mech.E., F.R.Ae.S., has been appointed to succeed him—as chief engineer (aircraft). Mr. Brennan was chief designer at Saunders-Roe from 1952 to 1959, having been with that company since 1937. In 1959 he became assistant chief engineer of Vickers-Armstrongs (Aircraft) and the following year was appointed director and chief engineer of Folland Aircraft.

Mr. Brennan's design experience covers a wide range, from marine aircraft to rockets. For example, he had much to do with the design of the Princess flying-boats and was responsible for the Saro SR.1 flying-boat jet fighter. He designed the SR.53 mixed-powerplant interceptor and its intended successor the 177; and was responsible for the Saunders-Roe contribution to the Black Knight re-entry research vehicle. Later he was closely concerned with the design of the SR.N1 Hovercraft. And his most recent activity has also been in connection with the Folland ground-effect research machine.

Gliding Champions

SGT. JOHN S. WILLIAMSON of the R.A.F., in which he is a radar instructor, became the new British gliding champion on Whit Monday, the last day of the National Championships at Lasham. For this he received the Londonderry Cup. He also received the McEvoy Trophy as winner of the R.A.F. individual championship, and a trophy from the Polish Air Force in Britain. He flew an Olympia 419 in League I, in which there were 50 entrants.

In the Inter-Services Championship the Emmett Trophy was won by the R.A.F., whose three best pilots, Sgt. Williamson, Wg. Cdr. J. Croshaw and Flt. Lt. F. D. Cretney, totalled 16,846 points as against 16,678 points by the Army team, Brig. A. J. Deane-Drummond, Capt. E. C. Shephard and W/O E. Stark.

D. C. Kerridge and A. D. Purnell alternately flying a Skylark 3F, won in League II, which had 40 entrants. They were awarded a Firth Vickers Trophy for this and the EoN Cup and Kemsley Cup for the Surrey Club who entered the machine.

P. G. Burgess, flying a Ka-6, became champion in the Standard Class (15 metres span) in League I and received the Pan American Trophy. B. J. Davey and R. T. Cole, flying a two-seater Eagle, received the Slingsby and Furlong Trophies.

J. Adamek, a visitor from Poland, who flew hors concours, received a special trophy.

ROYAL OPENING.—H.R.H. the Duke of Edinburgh made a short flight in a Piper Apache in the course of his visit to the College of Air Training on May 19 (see p. 578). With the Duke here is Capt. J. W. G. James, B.E.A. Flight Operations Director and chairman of the College Board of Governors.

Avrocar Flies

AVRO AIRCRAFT'S experimental "flying saucer," the Avrocar, made its first free flights at Toronto's International Airport on May 17.

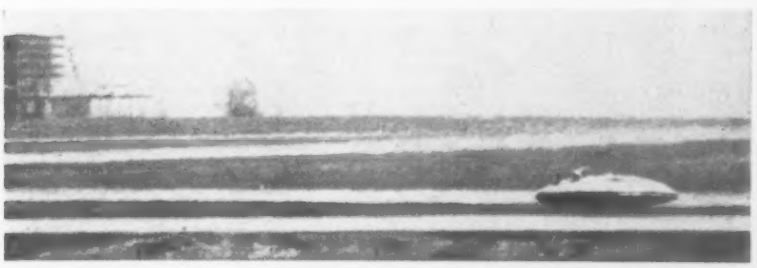
It made two flights along the airport's Runway 23, hovering about 15 to 20 ft. off the ground. It was airborne about five minutes on each of the flights. In previous tests it has been tethered.

The Avrocar is being developed by Avro as a tactical weapon for the U.S. Army. Avro Aircraft, Ltd., is a subsidiary of A. V. Roe Canada, Ltd., a member of the Hawker Siddeley Group.

The company refuse to release details of the tests, because of security restrictions imposed, it said, by the U.S. Army. However, the 90-minute series of tests were conducted in full view of hundreds of startled airline passengers and employees working at the airport.

Shimmering in the brilliant sunshine, the huge silver disc "bobbled" easily down the runway and back, bucking like a gentle pony. At the end of the runway it was put through a series of hovering tests, then flown back to the Avro factory located on the fringe of the airport.

The Avrocar is the brain-child of English-born Avro designer Jack Frost who began work on it in 1952. It is not a "hovercraft" or ground effect vehicle —it makes use of the Coanda Effect. G.K.



Air Matters in Parliament

Blue Streak and U.S. Rockets

THE American offer, conveyed on May 8 by Mr. Dean Rusk, United States Secretary of State, to the NATO council in Oslo, to furnish on request Scout, Thor and Atlas rockets for scientific purposes to NATO and other European organizations, has been quick to promote speculation and misgiving both in and out of Parliament as to its likely effect on the joint Anglo-French proposals for developing satellite launchers based on our Blue Streak rocket.

On May 11, MR. G. BROWN (Lab., Belper) asked the Prime Minister whether he accepted, in this context, that unless we ourselves provide some of the machinery involved and thereby learn the technological problems, we shall suffer a considerable blow nationally. And, if he accepted that, ought he not to remonstrate with our American allies about their apparent aim to keep us and our rockets out of the field? In reply, MR. MACMILLAN said he did not think that was the intention of the Secretary of State, and that he was informed that American launchers, if used, would be used from American bases, and would thus be additional to and not in place of a European or British system.

That did not altogether satisfy the House, and on May 15 MR. R. MASON (Lab., Barnsley) took up the cudgels again. MR. THORNEYCROFT answered that he did not anticipate any damage being done by the American offer. We contemplate, he said, an offer to manufacture jointly rockets which can be used for commercial and scientific purposes, and they will be made in Europe, which is quite different from the American offer.

MR. T. F. PEART (Lab., Workington) asked if it were the Government's intention to accept the United States Government's offer of launchers for space research. Mr. Thorneycroft replied: "We have already accepted a United States offer to make launchers available to put satellites into orbit containing experiments and instrumentation designed by us. We hope to continue to use United States launchers as well as European launchers in the future."

The prevailing anxiety was neatly summed up by Mr. Peart, who commented: "What people are worried about in connection with the Government's policy is whether the Government are prepared to make a decision. There has been so much complacency and dithering that we are rather worried. We are anxious to strengthen the Minister to do something."

Civil Aerodromes

On May 1 MR. A. ROBERTS (Lab., Normanton) asked whether it was intended in the near future to give financial aid to some of our domestic airports. Mr. Thorneycroft replied that, although airports as a whole in this country are at present being run at a loss, it was hoped this would be remedied by the, to him, very proper decision to raise landing charges; at the same time it should be remembered that they are already receiving some form of Government assistance. In reply to MR. J. SLATER (Lab., Sedgefield) he stated there are 71 civil aerodromes in England, 14 of which are operated by companies which also provide either scheduled or charter services. Of the 71, eight are operated by the Ministry of Aviation, 26 are licensed for public use and 37 for use only by the licensee and persons authorized by him. To MR. P. G. WILLIAMS (Cons., Sunderland, S.), who suggested that there exists some dissatisfaction with certain services presently provided by B.E.A. on a monopoly basis, he confirmed that questions of use and abuse of monopoly positions would properly be the concern of the newly established Air Transport Licensing Board.

Croydon or Blackbushe?

MR. C. F. H. GOUGH (Cons., Horsham) invited the Minister to make a statement on his plans for developing Croydon Aerodrome as a centre for business and private aviation. Mr. Thorneycroft said that the Minister of Housing and Local Government is considering representations made at the public inquiry in October, 1960, including a proposal that Croydon should be operated by a commercial organization for use by executive aircraft. Mr. Gough reminded him that since the end of the late War 18 airfields in the vicinity of London have been closed down, and said it would be a calamity if Croydon also closed down. Was the Minister fighting the battle on behalf of aviation in this connection? Mr. Thorneycroft replied that it might be necessary to have some further inquiry into certain technical points raised at the inquiry. On SIR A. V. HARVEY (Cons., Macclesfield) asking whether, in the event of Croydon closing, he will consider backing a syndicate to try to purchase Blackbushe Airport for the purpose in discussion, he suggested a question should be put down.—O. W. H. COOKE.

When, How and Why in Aviation

WHEN last year's edition of THE AEROPLANE DIRECTORY* appeared the mating season in the aircraft industry was in full cry and it was difficult to know who was who and who belonged to whom; so a loose leaf was inserted giving all the latest mix-ups. I think it is a pity that a very clear word picture has not been made a permanent feature in similar form; for it is not easy to see at a glance who belongs to what now. In future editions I would like to see this made plainer by insertions in heavy type in the section devoted to the Aviation Industry. These should come at the beginning or end of every entry saying to which group a firm belongs or whether it stands haughtily in splendid isolation. If any still can.

Under the entry for BEAGLE we have both Auster and Miles which starts on the right lines; but I looked in vain for the Pressed Steel component. Thinking everything about BEAGLE would come under that heading I was surprised to find a bit that had escaped and landed a couple of pages further on under British Executive and General Aviation, Ltd. (BEAGLE) just giving the top types at head office.

The compilers must have been faced with a considerable problem in presenting the new set-up of the industry so it's not surprising they've not got everything dead right first go. I would add that the general association of firms with one another can be seen under a list of holding companies, but I would prefer to see the heavy type entries already mentioned.

Having said that, there is nothing else much wrong with this always valuable guide and the standard of information is as near perfect as anything humanly devised can be. The Ministry of Aviation takes the place of that unregretted fossilized "Ministry of Silly Secrecy" (The Ministry of Supply). For the first time one can read all about it in five and a half pages telling one everything about the personnel, activities, and offshoots of the Ministry of Aviation.

In the Commercial Aviation section (which I would rather see called Civil Aviation, for all but the Services are commercial aviation, or supposed to be), the nationalized corporations will get a nasty shock to find that one of those "low-type" independent airlines, British United Airlines, occupies as much space as they (B.O.A.C. and B.E.A.) each do. The writing on the wall?

The "Who's Who" section occupies nearly 150 pages and the only person I cannot find, who ought to be there, is Peter Breen, the editor of *Air Mail* for several years and now editor of the new Air Ministry paper *R.A.F. News*, which isn't in the Aeronautical Press section. True the first number only came out in April but it was being planned last year. That is bad planning by the "Air House" and not the fault of the The Directory.

The Obituary list is distressingly long—a page and a half. But that must be expected now flying is nearing its diamond jubilee and the aeronautical community has grown from an intimate "family affair" into a vast business.

The comprehensive list of abbreviations now occupies four whole pages and is most useful to those of us who can't remember what these initials mean. I am glad that A.T.C. (in caps) for Air Training Corps gets precedence over a.t.c. (in small letters) for air traffic control. Serves 'em right!

One thing I have never understood in the make-up of this book is how the holders of Airline Transport pilot's (pilots' surely) licences has been allowed to escape from the airline section and get shoved in right at the end just before the index where it is apt to be overlooked.

A welcome addition is a built-in book marker as an advertisement for the Decca Navigator, a most appropriate advertisement for an instrument that tells you where you are in real life flying as well as The Directory.

Maybe it was a bit churlish to start this review by moaning and binding about the book's minor shortcomings. More than ever this is a work that no one, even remotely connected with aviation or cosmonautics, can afford to be without. I use the word cosmonautics advisedly rather than astronautics. For men are already dashing about in the cosmos; but even if we can ever go at the speed of light, 186,000 miles a second, we shall only be able to go to the very few stars that are only a a few light years' distant and get home within a lifetime. And until we *can* travel at the speed of light we can only go pottering locally to the nearer planets!

I will end by saying that everything anyone wants to know about U.K. and Commonwealth aviation can be found in this book and easily located by the comprehensive index.—G.D.

* "THE AEROPLANE" DIRECTORY OF BRITISH AVIATION.—584 pp., 8¾ in. by 5¾ in., Temple Press Limited. 35s. net or 36s. 9d. by post.

Aviation News in General

SUPERCHARGED.—The new five-seat Cessna 320 Skyknight is the first executive twin offered with turbo supercharged engines, which are 260 b.h.p. Continental TSIO-470-B flat-sixes. It is developed from the Cessna 310.

HELICOPTER SPEED.—A new World speed record for helicopters of 192.9 m.p.h. is being claimed by the U.S. Navy for the Sikorsky HSS-2. This was attained on May 17. The present rotary wing best speeds are 166.5 m.p.h. set up by an Mi-6 over a 100 km. closed circuit in November, 1959, and 162.7 m.p.h. over 3 km. established in November, 1956, by a twin-engined Sikorsky HR2S-1.

STARFIGHTER EQUIPMENT.—European Super Starfighters (see THE AEROPLANE AND ASTRONAUTICS, May 18) are to be equipped with navigation computers and a position and homing navigation display manufactured by Computing Devices of Canada, Ltd. This equipment is to be built under licence in Germany by Teldix, Ltd.

NAVAL AIR RADAR.—A Marconi Type S264A/H 50 cm. radar is to be installed at R.N.A.S. Yeovilton. In addition to the radar itself, five fixed coil display units, a video map and ancillary equipment have been ordered.

T-38s FOR GERMANY?—A Northrop T-38 Talon supersonic jet trainer is being evaluated by the German Air Force at Noervenich. There have been doubts in Germany about the wisdom of a flight training programme involving a step from the Lockheed T-33 to the two-seat version of the F-104 Starfighter, and the T-38 may be purchased to fill the gap.

RUSSIAN RECORD.—For a flight made on Apr. 29 by an An-10, the Soviet Union is claiming a new 500-km. closed circuit record for aircraft of more than 3,000 kg. Piloted by A. Mitronin, the An-10 averaged 730.616 k.p.h. (454 m.p.h.).

LATECOERE PROJECTS.—Three turbine transport projects have been announced by the French Latécoère company. They are the Latécoère 870, a high wing executive with slight sweep-back and two Astazou II engines; the Latécoère 853, a twin-Astazou freighter, and the Latécoère 863, a 38-passenger low-wing monoplane with four 1,000 h.p. Bastan IV turboprops.

SECOND SUB-ORBITAL.—The second U.S. launching of a manned Mercury space capsule is planned for Jne. 20. It will be launched by a Redstone booster over a similar trajectory to that of the first shot.

PARIS DIARY.—At the time of going to press the programme of events for the 10-day Paris Salon is as follows: May 26, official opening; May 27, executive and light aviation and stamp collectors' day; May 28, commercial aviation; May 29, air ambulances and aviation medicine; May 30, electronics; May 31, not allocated; Jne. 1, helicopters; Jne. 2, "foreign missions"; Jne. 3, international flight demonstrations; Jne. 4, international air show.

Paris Stop Press

Since going to press with our preview of British exhibits at the Paris Salon (pages 581-594), we have received news of the following companies' participation.

PALMER AERO PRODUCTS

A representative range of the flexible pipes and hoses made by Palmer Aero Products will be shown on the stand of the company's French associates Kleber Colomb. Palmer's products include Silvoflex (rubber), Fluoroflex (P.T.F.E.) and Corroflex (stainless steel) hose; stainless steel filters; as well as aircraft wheels and brakes. Palmer P.T.F.E. hose has been chosen for the Dassault Mirage III and IV and the DH Trident and Avro 748.

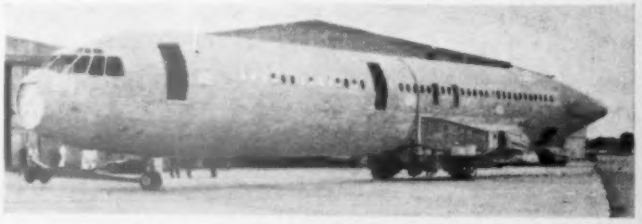
MICROCELL

Four types of glass-fibre 2-in. rocket launcher; the Double Travellite Mk. 2 economy class seat as fitted in the Avro 748; and a portable oscilloscope are exhibited by Microcell, Ltd. The rocket launchers on show are a retractable 14-tube fuselage unit; a 24-tube pylon-mounted wing launcher; a 37-tube under-wing unit; and a retractable 24-tube fuselage launcher.

AVIATION MEDICINE

On the U.K. Aviation Medicine stand Ultra Electronics are displaying SARAH homing equipment; the Walter Kidde organization are demonstrating their latest automatic life raft for use in conjunction with the Martin-Baker ejection seat; and Normalair are featuring a demand emergency oxygen system. The Chesterfield Tube Co. exhibit seamless gas cylinders for use in aviation medicine; Hymatic Engineering are showing valves and connectors for anti-*g* trousers, air-ventilated and pressure suits; M.L. Aviation have a partial pressure helmet on the stand; Airmed are displaying oxygen masks and head-sets; and a prototype Mk. 2 one-piece flying helmet is shown by Helmets, Ltd.

THE AEROPLANE AND ASTRONAUTICS next week will be another enlarged issue and will contain a full report of the Show and discuss the technical developments that are being displayed.



VC 10 JOURNEY.—The fuselage of the first B.A.C. VC 10 was moved from its assembly jig at the Vickers-Armstrongs Weybridge factory on May 7.

Commercial Aviation Affairs

B.O.A.C. TO WASHINGTON.—On Jne. 1, B.O.A.C. will inaugurate its Boeing 707 services between London and Washington. There will be four services in the first week and a daily service thereafter of which four a week will be by way of New York and three a week via Boston. The service will be operated into Friendship Airport to serve both Washington and Baltimore.

VISCOUNT DELIVERY.—The fourth Viscount 807 for New Zealand National Airways Corporation was delivered at Wisley on May 12. It was ordered in December, 1959 to supplement the three aircraft delivered early in 1958, and has been named "City of Dunedin." Viscounts will serve Dunedin when a new airport at Momona is completed early next year.

VANGUARD 953.—The first of 14 Vickers Vanguard 953s for B.E.A. made its first flight on May 1 and is about to be delivered. It has a higher gross weight than the six 951s in service with B.E.A. and a design payload of 37,000 lb.

CALEDONIAN AIRWAYS.—Delivery of the first Douglas DC-7C for use by the new Scottish charter company Caledonian Airways (Prestwick), Ltd., is scheduled for Dec. 1. It will be named "Star o' Robbie Burns." Managing director of the company is Mr. John de le Haye, and Captain Adam Thomson is his deputy.

M.E.A. POOL.—Middle East Airlines has concluded a pooling arrangement with Austrian Airlines for the Vienna-Beirut route, with effect from May 1.

EASTLEIGH HAND-OVER.—Nat Somers, well-known racing pilot and aviation personality, receives a symbolic key and the licence for Southampton Airport from Mr. C. M. Colbeck, divisional controller, M. o. A. The occasion was the official hand-over on May 15 of Eastleigh from the Ministry to Southampton Airport Ltd.

ARAB AIRCRAFT.—Deliveries of the fourth and fifth Comet 4Cs to United Arab Airlines are scheduled for Jne. 15 and Aug. 15 respectively. They will be used to increase the frequency on some routes, including Cairo-London, which will be flown daily from Aug. 1. New routes are also being planned, to Madrid, Moscow, Prague, Karachi and Bombay. U.A.A. recently purchased three DC-6Bs from S.A.S.

S-62 NEWS.—The first of two Sikorsky S-62 turbine helicopters was delivered to San Francisco and Oakland Helicopter Airlines on May 17 and the second was to be delivered in time for services to begin on Jne. 1. An S-62 has been ordered by the Canadian Department of Transport for search-and-rescue and light transport operations along the British Columbia coast.

AERODROME LICENCES.—Details of the conditions to be satisfied before the M.o.A. grants an aerodrome licence under the terms of the Air Navigation Order, 1960, are given in C.A.P.168, ("The Licensing of Aerodromes"), published by H.M.S.O., price 15s. Full compliance with the new standards will be required of all licensees by May 1, 1963.

C.P.A. TO LONDON?—Canadian Pacific Airlines has applied for permission to operate on Vancouver-Edmonton-London and Toronto-Montreal-London routes. The applications have been heard by a special cabinet committee but no decision has been made known.

NAVIGATORS' TEST.—From Aug. 1, a flight test will be included in the requirements for the initial issue of a Flight Navigator's Licence. Examiners will be appointed by the M.o.A., which is seeking nominations from companies and organizations in respect of their licensed navigators or pilots for this appointment. Requirements for examiners include five years as a navigator in public transport aircraft.

HARROWBEER REJECTED.—Plymouth Corporation's proposal to establish an airport at the disused R.A.F. aerodrome at Harrowbeer was rejected by a Select Committee of the House of Lords last week.

P.I.A. APPROVED.—Pakistan International Airlines has been approved by the A.R.B. for the overhaul, modification, repair and inspection of airframes, components and equipment, and for the overhaul of the R.-R. Dart, Wright Turbo-Compound and Pratt & Whitney aero-engines.

IATA MEMBER.—Viasa, the new Venezuelan international flag carrier, has become an active member of IATA.

News About People

B.O.A.C. DIRECTOR.—The Rt. Hon. The Lord Tweedsmuir, O.B.E., LL.D., has been reappointed a part-time member of the Board of B.O.A.C. for three years.

REPRESENTING H.S.A.—Air Vice-Marshal A. A. Adams has been appointed regional executive (NATO), for Hawker Siddeley Aviation. He takes up his appointment on Jne. 1 and will be based in Paris. Before retirement from the R.A.F. in 1959 he was Chief of Staff, F.E.A.F.

BROUGH REARRANGEMENT.—Following the appointment of Mr. N. E. Rowe to the Hawker Siddeley Aviation board, recorded elsewhere in this issue, Capt. E. D. G. Lewin, previously joint managing director with Mr. Rowe, becomes managing director of Blackburn Aircraft. Mr. B. P. Laight becomes chief engineer and Mr. R. H. Stone is now financial director. Other members of the Blackburn Aircraft board are Sir Roy Dobson, chairman, Mr. A. F. Jopling, deputy chairman, Mr. T. Bancroft, production director, and Marshal of the R.A.F. Sir John Slessor. Mr. J. T. Stamper is appointed chief designer (Buccaneer) and Mr. C. W. Prower chief project designer.

B.E.A. APPOINTMENT.—The Minister of Aviation has appointed the Rt. Hon. The Lord Balfour to the Board of B.E.A. for a further period of three years from Jly. 1.

GYRO GUIDANCE.—The Sperry Gyroscope Co., Ltd., announces the appointment of Mr. R. G. Hess as managing director in place of Mr. R. Broadbent who continues to serve as a director. The appointment of Mr. Hess, an American, is only temporary and is to strengthen the direct co-operation between the London and New York Sperry companies.

BALPA APPOINTMENTS.—Capt. R. I. Hill has been elected chairman of the BALPA Technical Committee in succession to Capt. M. W. Broom. He is a B.E.A. captain based at Renfrew and has been a member of the Technical Committee since 1955. BALPA also announces the appointment of Mr. John B. Bently as editor of *The Log*. He succeeds Mr. A. F. Sherman, the Association's assistant general secretary.

SHELL RETIREMENT.—Mr. C. M. Vignoles, managing director of Shell-Mex and B.P., Ltd., is retiring on Jne. 30 and is to be succeeded by Mr. J. E. H. Davies.

OBITUARY.—It is with deep regret that we record the death of Mr. Henry Bissell, chairman and founder of Cadmium Nickel Batteries, Ltd., after a short illness.

SMITHS VISIT.—A party of Freemen of the Guild of Air Pilots and Air Navigators visited Smiths Aircraft Instruments, at Cheltenham on May 9. Standing, left to right, are Mr. D. L. Brown, Mr. J. J. Mason, Sqn. Ldr. L. Bennett, Capt. S. B. Beevers, Flt. Lt. J. R. Green, Mr. R. A. Palmer, Mr. K. R. Dougan, Capt. A. Caesar-Gordon, Mr. A. J. Macdonald and Wg. Cdr. E. W. Anderson. Seated, left to right, are Mr. J. V. Holman, Mr. C. R. Jeffs, Capt. O. P. Jones, Mr. A. M. A. Majendie, Capt. G. Fowkes and Capt. E. Murray.

Air Transport

The Licensing Act on Trial

ACCORDING to the Shorter Oxford English Dictionary the verb "filibuster" means "to obstruct progress in a legislative assembly." At last week's A.T.L.B. hearings nobody was trying to obstruct the course of legislation, but the process of statement, counter-statement and cross-examination was so inordinately prolonged that "filibustering" seems to be the only word which can be used to describe the performance.

These hearings—at which B.O.A.C. was resisting Cunard Eagle's North Atlantic trunk-route passenger applications—were the first really important ones both for the board and the "public," so the contestants (or their legal representatives) may be forgiven for making such a thorough and long-winded business of it. Nevertheless, the onlooker found it hard to believe that this tortuous process, in which every word was balanced and every fact was questioned, is the most practical way of helping the members of the board to reach a decision—or to modify one which may already have been hardening in their minds on a basis of the extensive documentation available to them.

Certainly the practical effects of the prolonged process last week were seen to be somnolence, near-somnolence, or feigned somnolence among certain members of the "audience" (including at least one person who was specifically involved), and some possibly deliberately undisguised yawns from at least one member of the board.

Maybe—as someone who should know remarked privately after the second day—future hearings will tend to be shortened by the natural effect of the law of diminishing returns. Left to itself the whole process may, too, gradually be rationalized so that statements are reduced to a factual outline of a case followed by appropriate underlining of the main points and so that cross-examination is limited to the really crucial points.

There is, for instance, little to be gained from a prolonged examination of traffic estimations for the future made by various authorities—or from discussions about the possible allocation of this theoretical traffic. For better or for worse, the future can only be extrapolated from the past—using the longest possible period during which conditions have been comparable and making appropriate allowances for the effect of abnormal circumstances.

"Ripe for Competition"

Cunard Eagle's case for "dual participation" (a better term than the American "multiple designation") on a route which is "ripe for competition" was a good one, regardless of relatively unimportant differences in the traffic figures produced by the two opposing factions. Perhaps the most telling point made by B.O.A.C.'s representative was to the effect that the new traffic for another operator had, of necessity, to come either from B.O.A.C. or from the other operators on the route.

Diversion of traffic there obviously will be—but no one (at least before midday last Thursday) questioned the meaning of the words "material diversion." More important still, no one had, until then, spoken about the effect which the sales efforts of an additional carrier might have on the production of genuinely new traffic.

Passenger increases are not, after all, inevitable—they are made to happen by the introduction of new means of inducement (such as the tourist fares of 1952 and the economy fares of 1958) and by the positive sales and operational efforts of the individual airlines. It is not unreasonable to suppose that the efforts of a newly certificated carrier might be enough to provide all the extra traffic which it needs for survival—and which would not otherwise have been generated. There can be no statistics in a vacuum.

The hearings on the first afternoon (May 16) were devoted to an explanation by Mr. N. Ashton Hill, M.B.E., LL.B., of the case for Cunard Eagle Airways, of which he is a director. This explanation continued into the morning of the second day, which, with part of the third day, was largely taken up with a detailed cross-examination by Mr. H. A. P. Fisher, Q.C., acting for B.O.A.C. During the third day "witnesses" for Cunard Eagle's case were called and cross-examined—and, finally, the first part of the case for the objector, B.O.A.C., was put by Mr. Fisher. The fourth session was due to be held yesterday morning, May 24.

Mr. Ashton Hill's case—supported by figures and facts—was that the North Atlantic route (and, in particular, that between London and New York) was now ripe for "dual participation" and that the appearance on the route of a second British operator would be in the interests of British aviation as a whole. Before going into the facts of the situation he outlined Cunard Eagle's background of experience and the nature of its resources.

Between 1950 and 1960, inclusive, the annual North Atlantic traffic increases had ranged between 7.5% and 31.4%, with an average over the period of 20%. If this rate of increase were maintained during the next five years, the annual increase in the fifth year would be about 800,000 passengers—or more than double the increase (379,816) for 1960. Passenger load factors had been consistently high during these years, with an average of 65%. Even in 1960, when the largest-ever increase in capacity was offered, the load factor was maintained at 64.2%.

These figures are for total Europe-U.S.A./Canada IATA-member traffic, and, as Mr. Fisher pointed out during his cross-examination, are not necessarily significant in relation to U.K.-U.S.A. traffic trends. However, the Cunard Eagle case document (though some of its figures were later questioned and modified by Mr. Fisher on a basis of B.O.A.C. information) showed that the U.K.-U.S.A.-U.K. traffic had also increased by an average of 26% between 1957 and 1960. The average annual percentage share of passengers carried on this route by B.O.A.C. between 1953 and 1960 was, according to the Cunard Eagle figures, 37% and its average load factor was 64.5%.

A 5% Share

Assuming a mean U.K.-U.S.A. annual traffic increase of 20% per annum 1962-1965 and a load factor of 65%, it was estimated by Cunard Eagle that its proposed daily London-New York service with Boeing 707s would involve an annual share of the total traffic varying between 5.3% in 1962, 7% in 1963, 5.8% in 1964 and 4.8% in 1965. Such shares would not necesarily prevent B.O.A.C. from maintaining its 40% share of the total traffic.

Mr. Hill described the North Atlantic route as "No. 1" and the traffic potential as "absolutely limitless." So far, for simple legislative reasons, there had been only one British operator on the route—on which, if on any in the World, "dual participation" was justified.

In his cross-examination Mr. Fisher pointed to certain outdated anomalies in the Cunard Eagle application as set out, and then picked steadily away at the question of the validity of the traffic figures in relation to the proposed service and to the actual shares of the three operators primarily concerned. B.O.A.C. figures showed that its shares of scheduled passenger traffic for 1959-60 were 37.3% for U.S.A. (East), 59.6% for U.S.A. (mid-West), and 51% for Canada—with an overall average of 41.9%—on services to and from the U.K.

A good deal of time was spent in the discussion of forecasts based on Atlantic traffic potentials (all of which, incidentally, showed annual increases of much less than 20%) and of the effect of direct services from European centres on the traffic to be expected to and from London. In fact, such direct turbojet services have now been in operation for some time, yet the U.K.-U.S. passenger figures increased at a much higher rate (29-30%) in 1959 and 1960 than in 1958.

In his "evidence" Mr. H. R. Bamberg (chairman and managing director of Cunard Eagle Airways and now a director of the Cunard Steam-Ship company) explained his present plans for North Atlantic services. From May, 1962, there would, if the application succeeded, be a daily service each way between London and New York; from October, 1962, Montreal (or Toronto) would be initially introduced as a traffic point on certain of these services before a direct London-Montreal service was later started.

Mr. Bamberg and Sir John Brocklebank (the chairman of Cunard) were questioned about financial resources and, inevitably, about the fact that Cunard could find £6 million for the Boeing 707 purchase yet was to borrow money from the Government for the new "Queen." The differences between the two investments were explained.

Although the board is not, presumably, concerned with questions of traffic rights, some time was spent, with the competent aid of a U.S. attorney, in discussing the likelihood, or otherwise, of obtaining a foreign air carrier permit for a second U.K. operator and the possible reactions of the U.S.A. to the new situation.

In opening the case for B.O.A.C. Mr. Fisher said that the

Air Transport . . . .

application struck at the very heart of B.O.A.C. enterprise and that the granting of a licence to Cunard would do a very serious injury to the corporation. There was a substantial amount of public money invested in B.O.A.C. The North Atlantic route was intensely competitive; there were 18 U.S. and other foreign carriers serving the route and 10 of these were operating through the U.K.

B.O.A.C. had pioneered the development of this and other routes and now Cunard Eagle were proposing to come in and "share the prize . . . without having borne any of the heat and burden of the day." The plain intention of present legislation was that routes where the corporation had an established position, and on which it was committed to a future programme, were not to be broken into. "You may think," Mr. Fisher added, "that this application is an attempted rescue operation for the falling fortunes of the Cunard Steam-Ship Company. You may think they need a rescue operation."

B.O.A.C. had ordered British aircraft worth £140 million to cater for the future British share of the market on its routes. By 1966-67 the total capital employed on current operations would be £215 million and about 33% (£71 million) of this would be employed on the routes which the licensing board was now considering. If independent services were authorized it was likely that some of these aircraft would become redundant and the corporation's profits would be jeopardized.

The North Atlantic Cargo Agreement

THE most significant feature of the new IATA North Atlantic cargo rates—which, as briefly recorded in last week's issue, were finally agreed on May 15—is the fact that there are differences between those for eastbound and westbound consignments. Admittedly, the differences are comparatively minor ones, but they show a new trend of thinking which may lead, in future, to more important directional variations in the rates.

Whereas the new standard rates (see table below) involve six differently priced consignment weights (the so-called weight-breaks) up to 1,000 kg., there is a special additional weight-break at 7,500 kg. to encourage bulk shipments from America to Europe. The system of special commodity rates has been very much simplified and reduced from the present 75 categories to 24 on westbound flights and to 15 on eastbound flights.

Consignment Weights (kg.)	London-New York (Rate per kg.)
Under 45	15s. 9d. ($2.20)
" 100	10s. 11d. ($1.52)
" 250	7s. 11d. ($1.10)
" 500	6s. 6d. ($0.90)
" 1,000	5s. 9d. ($0.80)
Over 1,000	5s. 2d. ($0.72)
" 7,500 (eastbound only)	4s. 11d. ($0.68)

The new rates will, if government-approved, come into use on Sept. 1 and will remain effective until Mar. 31, 1963. Existing rates will meanwhile remain in force.

The chairman of the conference, Mr. H. Bryan Renwick (vice-president of C.P.A.), said at its conclusion that "the new rating system will transform the technological revolution in air transport into an economic revolution in distribution and marketing." In other words, now that we have suitable aircraft coming along and a simplified rating system at lower price levels, the maximum pressure will now need to be applied on the sales-explanation side so that the traffic can be fully developed in readiness for the next series of rate cuts.

Training Tomorrow's Captains

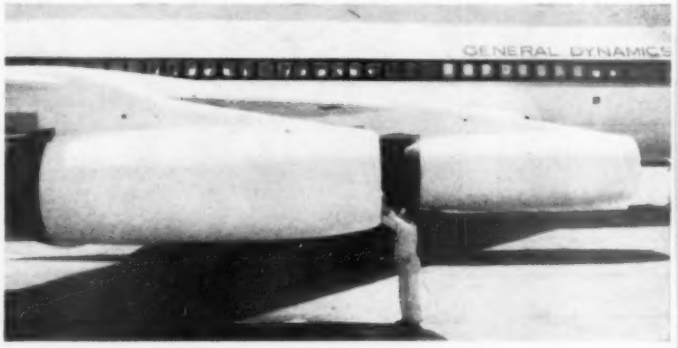
THIRTY-EIGHT students are now in training at the College of Air Training, Hamble, which was formally opened by H.R.H. the Duke of Edinburgh on May 19. These students have now completed one-third of their two-year course, at the end of which they will graduate with a commercial pilot's licence with full instrument rating, and with the necessary academic qualifications for an airline transport pilot's licence.

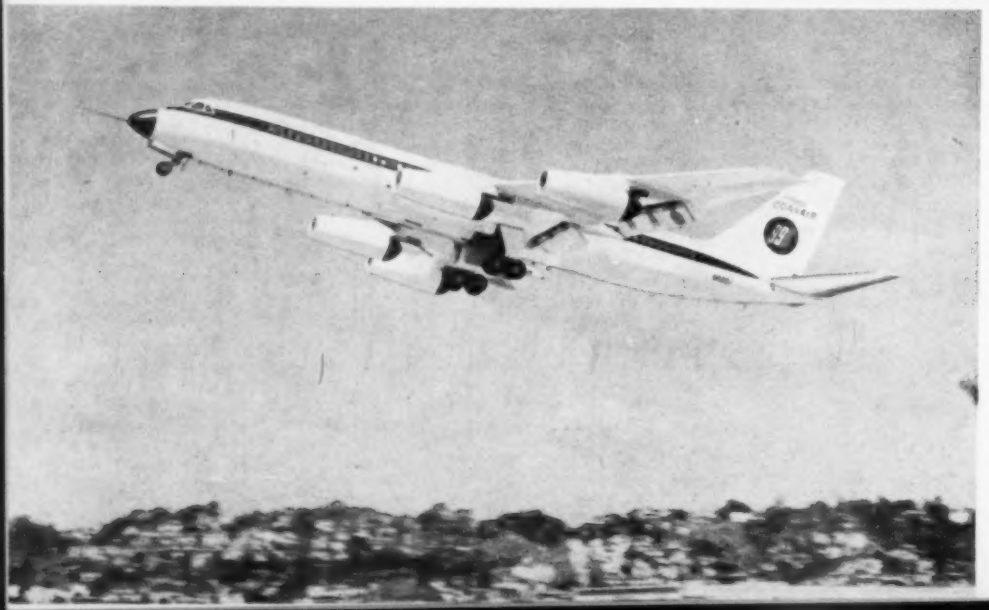
General details of the course were given in our issue for Sept. 23, 1960. In addition to the academic training, which is given on a broad basis, the course includes 150 hours on D.H. Chipmunks and 75 hours on Piper Apaches, plus 80 hours' instrument and navigation training in Link trainers and 60 hours' instrument, navigation and procedure training on simulators.

The aircraft fleet is to comprise 21 Chipmunks and nine Apaches; six of the latter are now at Hamble after their mass delivery flight across the Atlantic. The first of two General Precision Systems electronic procedures trainers was also delivered to Hamble recently (see page 596).

All the students now at the college expect to go to B.O.A.C. in 1962 as trainee second officers. The next intake, in September this year, will include cadets destined for both the corporations, and from then onwards groups of about a dozen students at a time will join the college every six weeks, so that the full complement, of about 200, will be reached by September, 1963.

Of the total cost of training each student—about £5,000 when the college is fully utilized—the Government is contributing £1,000 and the trainee is expected to contribute £675, part or all of which will in most cases be covered by grants from local education authorities. The remainder of the cost is borne by the corporations.





CONVAIR TESTS.—As we briefly recorded last week, the prototype Convair 990 has been flown to a speed of Mach 0.97 in the course of resumed trials following modifications to the outer pod and pylon. Shortening of the pylon served to move the pod back by 28 inches (see above) and was necessary to achieve the required damping of induced vibrations. In the new test flights, made by Don Germeraad, Mach 0.97 was reached at 27,500 ft., representing a T.A.S. of 675 m.p.h. At 14,000 ft., the Convair 990 has achieved 640 m.p.h. T.A.S.

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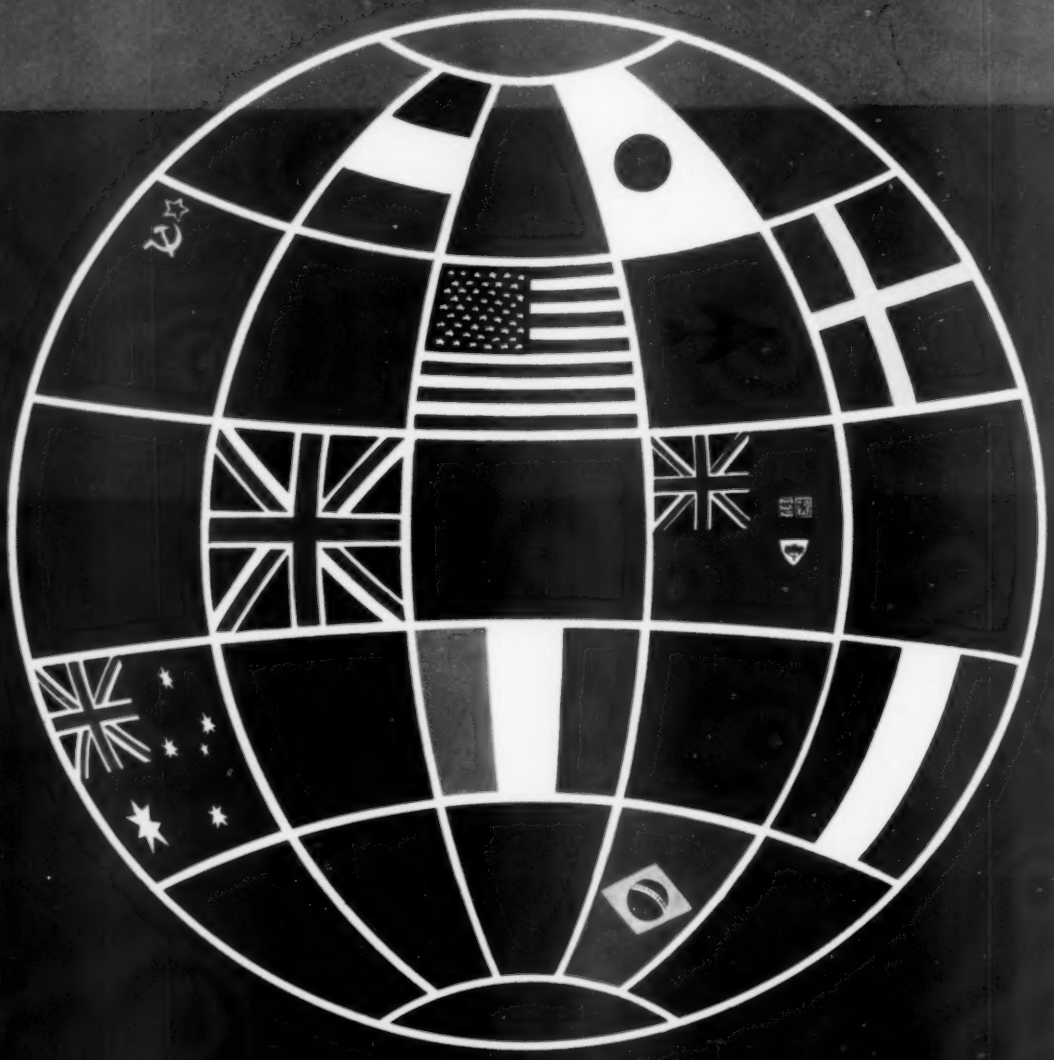

FRANCE: SA Caravelle Breguet 1150 Atlantic Transall C160 Mirage 3
SWEDEN: SAAB Lansen SAAB Draken ITALY: Fiat G91T JAPAN: Namco YS11
HOLLAND: Fokker Friendship USA: Boeing 707 USSR: Rover APU

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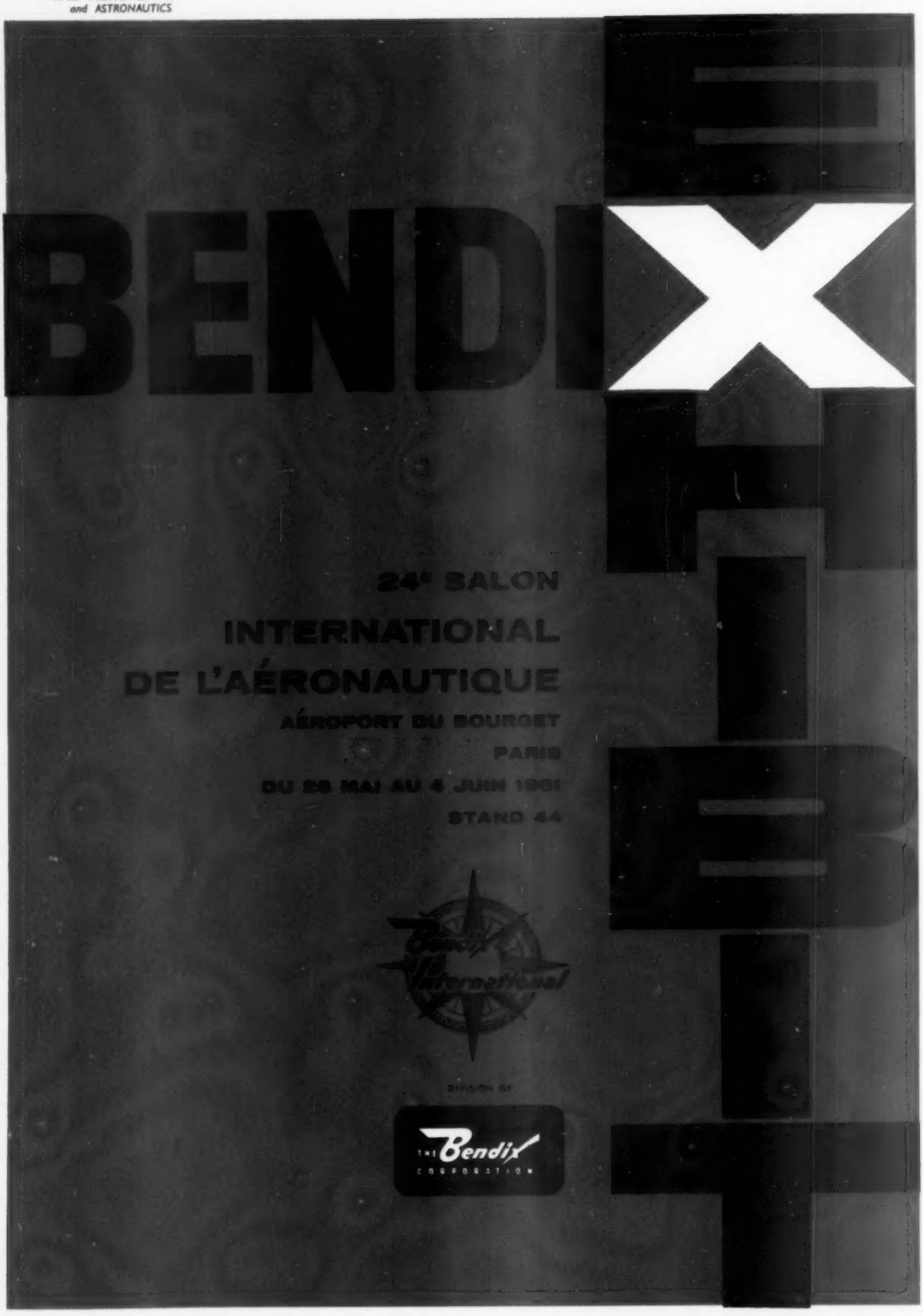
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Air Transport . . . .

American Airlines Chooses Boeing

AMERICAN AIRLINES has followed the lead given by United and Eastern, and has selected the Boeing 727 as new equipment for its short-to-medium haul routes. A letter of intent for 25 was announced last week, and is no doubt only the first instalment of a total requirement for a considerably greater quantity. A contract is now being negotiated.

The choice, for American, lay between the Boeing 727, a version of the de Havilland Trident, the developed Sud-Douglas Caravelle and a Convair project. The Caravelle apparently was ruled out as long ago as last November; speaking informally to the Press at Seattle in that month, Mr. C. R. Smith, American's president, said that a twin-engined aeroplane did not meet the airline's requirements. De Havilland, with a developed version of the Trident, probably offered the strongest competition for this particular order and the fact that it has gone to Boeing is a serious blow for the British company.

Deliveries of the 727 to American Airlines, whose order is worth over $100 million, will begin in 1964. Boeing already has announced orders for 92 of their three-JT8D-1-engined short-haul jet, 40 each for United and Eastern and 12 for Lufthansa. The American order will bring the total sold to 117, and Boeing jet transport sales now total 429.

Competition for the One-Eleven

ONE of the points stressed by Sir George Edwards in introducing the B.A.C. One-Eleven rear-engined short-haul jet earlier this month was that no other comparable type was at present available. Thus far, at least, the One-Eleven is following in the steps of the Viscount, for which it is a jet successor; but it is hardly to be expected that competitive aeroplanes will not appear, especially if the market for this kind of aeroplane is as good as B.A.C. believes.

Perhaps the biggest threat at the present time comes from Sud-Aviation with the SA220 Caravelle Junior. Powered, like the One-Eleven, by two rear-mounted Rolls-Royce Speys, the projected Caravelle Junior is a smaller version of the Caravelle, to seat 62 tourist-class passengers on short hauls, operating from small airfields. Its future is by no means assured and Sud apparently requires some measure of Government backing —as B.A.C. already has for the One-Eleven; but if the Caravelle Junior does proceed, it will be a collaborative effort involving Douglas as well as Sud, and might thereby obtain a foothold in the U.S.

Another European project, about which little has yet been said, is a Fokker short haul design based on two Bristol Siddeley BS75 turbofans. These engines are being developed as a private venture for just this kind of application, and are specified for the B.A.C.107, which may follow the One-Eleven in due course. They were also specified for the Avro 771, similar in most respects to the 107. The future of this project, as of the Spey-engined Avro 761 and of the de Havilland D.H.126, all in broadly the same class, seems doubtful in view of the decision to proceed with the One-Eleven.

Flight Control for the 727

DETAILS have been given of the Sperry SP-50 automatic flight control system, which is to be used in the Boeing 727. Boeing Transport Division has awarded Sperry Rand Corporation a development contract which is estimated to be worth more than $7 million over the next several years.

The SP-50 basically comprises a flight controller, through which the pilot can apply commands to the automatic control system; the sensory equipment which detects variations in the normal flight axes; and the electronic computers and amplifiers which compute, from the flight controller and system sensors' inputs, the commands to be transmitted to the control system hydraulic actuators.

Among the requirements specified by Boeing are separate packaging of the electronic controls for pitch and roll control and for a dual yaw damper system. Emphasis is being placed upon ease of maintenance by grouping components, and a high degree of reliability. Breakdowns or degradations in performance are, Sperry claim, two or three times less likely to occur as a result of techniques such as using electronic components at only a fraction of their rated capacity.

Aeroflot holds a Press Conference

GENERAL-COLONEL E. F. Loginov, chief of Aeroflot, held a Press conference at Moscow Vnukovo airport on May 11, to outline Aeroflot's plans for the future and to display new turbine-powered transports. The general spoke of the growth of Aeroflot but, once again, failed to give one single statistic which would provide a base from which the growth could be gauged.

In 1961, Aeroflot traffic is expected to increase by 35-40% over the 1960 level. The Yakutsk air group alone, said the general, would handle as much traffic as did the whole of Aeroflot in 1940 [the Aeroflot results for 1940, and the nature of the Yakutsk air group, unfortunately went unrecorded].

At present, 40% of the Aeroflot routes are flown by turbojet or turboprop aircraft. By the end of this year the proportion will be 60%, and by 1965 it will be 90%. Fares continue to decrease by 15-20% per year, and progress is being made with the introduction of all-weather safety aids.

The Mil Mi-6 was reported to be coming into service for work on pipelines, high-voltage cables and for building oil-boring towers.

Following the Press conference, the Antonov An-14A Pchlka, the An-24 and the Tu-124 were shown to correspondents, together with the An-10, Tu-114 and other types. The high-wing 32/40-seat turboprop An-24 was described as being suitable for Russian local routes. The take-off distance is 1,320-1,500 ft., cruising speed 310 m.p.h. and range 500-745 miles.

The Tu-124 is intended for use on routes of up to 950 miles and will fly on some international routes in Europe as well as domestically in Russia. With Soloviev turbofan engines, it is a close relative of the Tu-104 and seats 44-60 passengers. For short-field performance, the wing has been "mechanized"—a reference, perhaps, to leading-edge flaps.

ISLAND HERALD.—Jersey Airlines, whose plans for the Handley Page Herald were discussed in our previous issue, inaugurated scheduled services with this turboprop feeder-liner on May 19. These pictures show the Herald over Jersey Airport and Mr. M. L. Thomas, chairman and managing director, with Miss Maureen Barker, stewardess on one of last week's inaugural flights.

Photographs copyright "The Aeroplane and Astronautics"

The Fighting Services

Honorary Air Commodore

THE Duke of Hamilton and Brandon has become the first Honorary Air Commodore of No. 2 (City of Edinburgh) Maritime Headquarters Unit, R.Aux.A.F.

First commissioned as a Pilot Officer with No. 602 (City of Glasgow) Squadron, R.Aux.A.F., in 1927, the Duke of Hamilton became C.O. of the squadron in 1931 and served in that capacity until 1936, when he was promoted to Wing Commander. He became Honorary Air Commodore of No. 945 Squadron, R.Aux.A.F., in December, 1940, and in the next year was promoted to Group Captain.

In 1945 he was appointed Honorary Air Commodore to No. 602 (City of Glasgow) Squadron, and in 1949 he was given similar appointments with No. 2602 and No. 3602 Squadrons, all of which have now been disbanded.

No. 2 Maritime Headquarters Unit was formed in November, 1959, to provide backing for the R.A.F. component of the Joint Naval-Air Maritime Headquarters at Pitreavie, Edinburgh. It is functionally controlled by Coastal Command and the C.O. is Wg. Cdr. K. Gray, R.Aux.A.F.

Wright Jubilee Trophy Results

HELD at the Central Flying School, R.A.F. Little Rissington, earlier this month, this year's competition for the Wright Jubilee Trophy was won by Flt. Lt. D. A. Proctor of No. 7 Flying Training School, Valley, with Flt. Lt. P. A. Clee of No. 1 F.T.S., Linton-on-Ouse, second, and Sqn. Ldr. P. D. G. Terry of the R.A.F. College, Cranwell, third. All three were flying Vampire T.11s.

The Trophy, presented to the Service by the R.A.F. Association in December, 1953, is competed for by a selected flying instructor from each of the Flying Training Command jet Flying Training Schools. The competition comprises a standard sequence of aerobatics followed by two minutes of voluntary aerobatics undertaken as a continuous manœuvre.

This year's judges were Wg. Cdr. K. F. W. Tapper, Sqn. Ldr. K. A. Williamson, Sqn. Ldr. A. P. Trowbridge and Sqn. Ldr. P. K. V. Hicks—all members of C.F.S. staff. The Commandant, Air Cdre. H. P. Connolly, had the casting vote.

Senior Appointments

AIR VICE-MARSHAL J. G. W. WESTON, C.B., O.B.E., is to become Director-General of Manning at the Air Ministry in July. A member of the Senior Directing Staff of the Imperial Defence College since March, 1959, he was previously Assistant Chief of Air Staff (Signals) and has commanded No. 90 (Signals) Group.

Air Cdre. P. T. Philpott, C.B.E., is to join the Senior Directing Staff of the Imperial Defence College this month, with the acting rank of Air Vice-Marshal. He has been Director of Joint Plans at the Air Ministry since September, 1959.

Two other appointments with promotion to the acting rank of Air Vice-Marshal have also been announced. Air Cdre. D. F. Spotswood, C.B., C.B.E., D.S.O., D.F.C., is to become Assistant Chief of Staff, Air Defence Division, SHAPE, in June, and Air Cdre. T. N. Coslett, O.B.E., is to be A.O.C., No. 24 Group, Technical Training Command, with effect from Jly. 27. Air Cdre. Spotswood has until recently been A.O.C. and Commandant of the R.A.F. College, Cranwell, for the past 2½ years, and Air Cdre. Coslett has been Commandant of No. 1 School of Technical Training, R.A.F. Halton, since April, 1958.

Until recently commanding R.A.F. Locking, Air Cdre. H. G. Leonard-Williams, C.B.E., has been appointed Chief Signals Officer at Headquarters, Fighter Command. In 1953 he became Deputy Director of Signals at the Air Ministry.

Air Cdre. R. A. C. Carter, C.B., D.S.O., D.F.C., has been appointed Air Officer in Charge of Administration, R.A.F. Germany, having been Director of Personal Services (A) since June, 1958. His post at the Air Ministry has been taken over by Gp. Capt. R. E. Craven, O.B.E., D.F.C., with the acting rank of Air Commodore.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. G. T. Lester to the Department of the Air Member for Personnel; Wg. Cdr. R. G. C. Castell and Sqn. Ldr. R. W. Clark, O.B.E., with acting rank of Wg. Cdr., to the Department of the Air Member for Supply and Organization.

Bomber Command: Gp. Capt. P. H. G. Wintle, D.F.C., to R.A.F. Wyton to command; Wg. Cdr. B. A. Primavesi to No. 50 Squadron, R.A.F. Waddington, to command; Wg. Cdr. S. S. Dodds to Headquarters for engineering duties; Wg. Cdr. P. R. Mallorie, A.F.C., to No. 230 Operational Conversion Unit, Waddington, as Chief Instructor; Sqn. Ldr. J. Wilson, M.B.E., to No. 7 Squadron, Wittering, to command, with acting rank of Wg. Cdr.

Fighter Command: Gp. Capt. K. P. Smales, D.S.O., D.F.C., to Headquarters No. 11 Group as Gp. Capt., Operations.

Transport Command: Wg. Cdr. P. Ainley, D.F.C., to Headquarters for air plans duties.

Technical Training Command: Wg. Cdr. A. Powell to Headquarters for accounts duties.

Maintenance Command: Sqn. Ldr. S. M. Russell to R.A.F. Swanton Morley to command the Aircraft Services Wing, with acting rank of Wg. Cdr.

Near East Air Force (Cyprus): Gp. Capt. C. M. Clementi, O.B.E., M.A., to Headquarters as Gp. Capt., Plans.

Air Forces Middle East (Aden): Wg. Cdr. F. G. Dummer to No. 131 Maintenance Unit, Khormaksar, to command.

Far East Air Force: Gp. Capt. R. S. Radley, D.F.C., A.F.C., to Headquarters as Gp. Capt., Organization.

Other Appointments: Wg. Cdr. J. S. Owen to Teheran as Air Attaché, with acting rank of Gp. Capt.; Gp. Capt. C. R. C. Howlett to the Ministry of Aviation, Boscombe Down, to command the Armament Wing; Wg. Cdr. H. Knowles to the 2nd A.T.A.F., Germany, to command the International Support Unit; Wg. Cdr. R. W. Mathers, D.F.C., to R.A.F. Luqa, Malta, to command the Administrative Wing; Wg. Cdr. G. M. Heath-Smith, M.B.E., to Allied Forces Northern Europe; Wg. Cdr. L. A. Marland to Allied Air Forces Central Europe; Wg. Cdr. R. D. G. White and Wg. Cdr. W. J. L. Sheehan, D.F.C., to the Ministry of Aviation.

More Service News

No. 47 Squadron Reunion.—No. 47 Squadron will be holding a reunion dinner in London in August. All former members are cordially invited to write for full details to the Squadron Adjutant, R.A.F. Abingdon, Berks.

Gliding in Germany.—A new summer gliding centre has been opened at R.A.F. Gutersloh. Under the control of Flt. Lt. C. Morgan, it will remain open until September.

C.F.S. AEROBATICS.—This year's Central Flying School aerobatic team was to make its United Kingdom debut at North Weald on Whit-Monday and will perform at the Paris Aero Show next week. Flying four Hunting Jet Provost T.3s, the team comprises Flt. Lt. F. R. Brambley (leader), Flt. Lt. D. T. McCann (No. 2), Plt. Off. B. A. McDonald (No. 3) and Flt. Lt. T. H. Whittingham (No. 4). The reserves are Flt. Lt. I. K. McKee and Flt. Lt. W. W. Elsegood.

EXHIBITS AT THE PARIS SHOW

In this 14-page supplement we review the contribution that the British airframe, aero-engine and ancillary industries are making to France's biennial air display and exhibition now being held at Le Bourget. Also included are some notes on non-British participation.

British Aircraft at the Salon

AIRCRAFT manufacturers from the U.K. are showing their wares in some force at this year's Paris Aeronautical Salon. All the major concerns are represented and their products are displayed either "in the flesh" or in model form, in the exhibition hall or in the static aircraft park. The following notes give details of these contributions to the 1961 Salon.

BRITISH AIRCRAFT CORPORATION

The new B.A.C. One-Eleven short-haul jet transport will feature prominently on the British Aircraft Corporation stand. This project is now going ahead as the first aeroplane in its class; seating 57-69 passengers, it is powered by two rear-mounted Rolls-Royce Speys and will operate from 4,800 ft. runways over ranges up to 700 nautical miles at operating costs as good as or better than those of the Viscount 810. British United Airways has ordered 10, and Ozark Airlines, with a letter of intent for five, is one of several U.S. local service and trunk carriers very interested in the project.

Bristol Aircraft.—From this member of the British Aircraft Corporation comes a Britannia 253, which is one of 20 in service for long-range operation with R.A.F. Transport Command; it is shown as a Service exhibit. In the interior display are models and details of the Bristol 188 Gyron Junior-powered stainless-steel research aircraft for prolonged flight at speeds above Mach 2. First flight of the prototype of this aircraft is imminent.

English Electric Aviation.—Contribution by the English Electric company takes the form of the Lightning F.1s of No. 74 Sqn., four of which are performing in formation, and possibly a single similar aircraft. Lightnings are equipping Nos. 74, 56 and 111 Sqns. of Fighter Command, and more advanced versions have been promised in the Air Estimates for the R.A.F.

Hunting Aircraft.—No aircraft are being shown individually by this member of the B.A.C. but the C.F.S. formation aerobatic team of four Jet Provost T.3 trainers will be one of the R.A.F. attractions in the flying programme.

Vickers-Armstrongs (Aircraft).—Due to fly next year and the largest transport aircraft project in Europe, the VC.10 will be represented by models on the British Aircraft Corporation stand. Details may be announced of the Super VC.10 in the form in which it will now be built for B.O.A.C.—rather smaller than at first projected but with better all-round economics. The corporation is planning to take 15 VC.10s and 30 of the new Supers.

Last aircraft product of the Supermarine division of Vickers-Armstrongs, the Scimitar strike-fighter is represented at Paris in a formation aerobatic team of the Royal Navy. This transonic strike-fighter equips two or three Fleet Air Arm squadrons, and is to add the American Sidewinder AAM to its formidable range of armament which includes nuclear weapons.

Photograph copyright "The Aeroplane and Astronautics"

FIRST OF THE MANY.—Initial product from the BEAGLE group, the handsome Auster Airedale is flying in the Paris Show.

BEAGLE-AUSTER

Main exhibit on the Beagle-Auster stands will, of course, be the new A.109 Airedale, represented by two prototypes. One is on the company's stand in Hall C, while the other is on show in the aircraft park. Rapid progress with the flight-test programme has been achieved since the first prototype, G-ARKE, made its initial flight at Rearsby on Apr. 16. Tropical trials are being undertaken in North Africa, and firm orders have already been placed for several Airedales. In standard form, including a constant-speed airscrew for its 180-b.h.p. Lycoming, the Airedale costs £4,750, ex-Rearsby.

HANDLEY PAGE

As one of the few remaining "independents" in the British aircraft industry, this company is represented at Paris by a production example of the 44/50-seat Herald twin-Dart light transport, for which orders have now been placed by Jersey Airlines, B.E.A., and a Canadian company. Outside the main exhibition hall, Handley Page has small displays featuring the Herald, the Victor B.1 and B.2 (which are flown in the R.A.F. programme) and laminar-flow work connected with the H.P.115 Viper-powered research aircraft.

STOL PERFORMER.—A newcomer to the Paris Show is the DHC-4 Caribou, which is the largest STOL transport in service. The example shown is in U.N. colours as part of Canada's contribution to the United Nations Emergency Force in Egypt. Four Caribou are operated by the R.C.A.F. from El Arish.

HAWKER SIDDELEY GROUP

A. V. Roe.—Two prototypes of this company's Type 748 short/medium-range twin-Dart 40/48-seat feederliner are currently flying, the first since Jne. 24, 1960, and the second from earlier this year. Production of the first 10 (including a Series 2 version with R.Da.7s) is well advanced, and work on a further 50 has been authorized. Apart from the prototype in the flying display, models at Paris show the 748 in Aden Airways, B.K.S., Aerolineas Argentinas and Skyways colours, plus those of the Indian Air Force, for which the military Avro 757 has also been ordered. An Avro Vulcan B.2 (four 17,000-lb. Olympus 210s) of the type in service with three R.A.F. Bomber Command squadrons is also at Le Bourget.

Armstrong Whitworth Aircraft.—Main exhibit of this Hawker Siddeley Group member is the prototype A.W.660 Argosy C.1 military freighter, which first flew on Mar. 6 this year. Fifty-six A.W.660s have been ordered for R.A.F. Transport Command; contracts for the civil A.W.650 Argosy, which has been in service with Riddle Airlines since the beginning of 1961, have also been placed by B.E.A. Models shown by Armstrong Whitworth include the projected A.W.670 Air Ferry and 114-seat Airbus versions of the design, with new fuselage accommodating eight cars plus 32 passengers.

Blackburn Aircraft.—One of the completed development batch of 20 N.A.39 Buccaneer transonic low-level strike aircraft for the Royal Navy is flying in the Le Bourget programme. Operational trials of this aircraft are now in progress with No. 700 "Z" Squadron. Production of a "substantial number" of Buccaneers continues for the Royal Navy while a promising land-based potential is also projected. Mention can now be made of the Buccaneer Mk. 2, which is powered by two Rolls-Royce Spey by-pass turbojets.

GNOME-POWERED.—With its 1,050 s.h.p. D.H. Gnome free-turbine, the Westland Whirlwind Series 3 has a greatly improved performance in high temperatures and altitudes.

De Havilland Aircraft.—One of the biggest exhibitors at Le Bourget is this vigorous member of the Hawker Siddeley Group, which, with its associated Canadian company, is showing a half-dozen civil aircraft types in the static and flying programmes, plus details of several new projects inside the exhibition hall. Familiar from many Farnborough appearances are the Heron and Dove executive and light transport aircraft, the latter shown in its new Mk. 8 form with fuel-injected Gipsy Queen 70-3 engines and additional oil-cooling area above their nacelles.

A high-density Comet 4B or 4C will also be shown, according to availability, while in model form are the D.H.121 and 125 projects. Although of comparable configuration, these two designs are of very different size—the D.H.121 or Trident being an 83/100-passenger short-haul transport with three rear-mounted Rolls-Royce RB.163s for B.E.A., which has 24 on order, while the D.H.125 is a twin-Viper executive type scaled down to carry eight passengers plus crew. Thirty D.H.125s are being laid down as a private venture, and there is considerable interest in the type from corporate operators in the U.K. and overseas.

De Havilland Canada is showing its range of versatile STOL transports, which comprise the DHC-2 Beaver (more than 1,500 built); DHC-3 Otter (300-plus produced); and the DHC-4 Caribou (about 70 ordered to date). The Caribou at Le Bourget is one of the all-white aircraft in United Nations markings

LE BOURGET HIGHLIGHT.—For those who did not see it at last year's S.B.A.C. Display, the Short SC.1 flat-riser VTOL research aircraft will come as a revelation at Le Bourget.

operated by the R.C.A.F. on UNEF detachment in Egypt to maintain the truce line. Its STOL and soft-field capabilities are put to good use in desert operations. Models in the Salon show the Caribou prototype which is being converted to turboprop power by the installation of two 2,600 s.h.p. General Electric T64 gas-turbine powerplants.

Folland Aircraft.—In production as an advanced trainer for the R.A.F., the Gnat two-seater is represented in the Paris flying and static programmes by one of the evaluation quantity of 14 aircraft. Thirty more have since been ordered for Flying Training Command. The Gnat Trainer is powered by a 4,230-lb. B-S Orpheus 100 (BOr.4).

Gloster Aircraft.—A static exhibit from the R.A.F. is a Fighter Command Javelin F.A.W.9, with two 12,390-lb. Sapphire ASSa.7LR limited-reheat turbojets, and carrying full armament of four D.H. Firestreak air-to-air missiles plus two 30-mm. Aden cannon.

Hawker Aircraft.—From this lively member of the Hawker Siddeley Group is exhibited in the flying display the Hunter Trainer T.Mk.66A demonstrator, G-APUX, which has been engaged in prolonged trials of erect and inverted spins. The engine is a 10,000-lb. Rolls-Royce Avon 203.

SHORT BROTHERS AND HARLAND

One of the highlights of the Paris Aero Show flying programme will be a complete VTOL flight plan by the Short SC.1 "flat-riser." Powered by four tilting lift turbojets and one thrust unit, all Rolls-Royce RB.108s, the SC.1 will be flown by Mr. Alec Roberts, one of the Short test pilot team.

Shorts are also showing a 1/24th model of the SC.5 Belfast freighter, of which 10 are on initial order for the R.A.F. Typical Belfast loads illustrated are three Saladin tanks, three Saracen tanks, six Ferrets or 12 quarter-ton trucks. Capacity payload is 85,000 lb.

On a similar scale is a model of the SC.7 Skyvan, the prototype of which is nearing completion as a private venture. Its capacity payload is 3,000 lb.

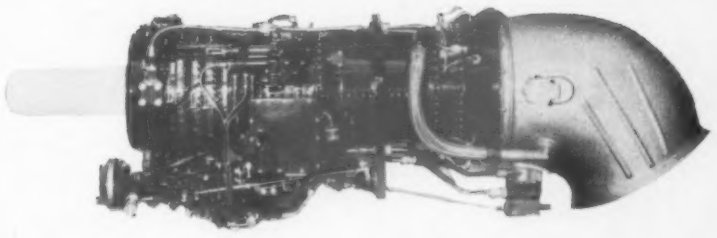
WESTLAND AIRCRAFT

Taking in the VTOL activities of Bristol, Fairey and Saunders-Roe, as well as continuing its own extensive developments, the Westland group is one of the biggest helicopter companies in existence. Spearheading its exhibition effort of five rotorcraft at Le Bourget is the World's first vertical take-off airliner—the Rotodyne "Y." Since it last visited the Continent, the Rotodyne has completed a considerable number of flying hours (it first flew in November, 1957), and some modifications have been incorporated. These include a rotor head fairing and a third fin on the tailplane. Design of a much larger version, with two 5,250 s.h.p. Rolls-Royce Tyne turboprops/compressors instead of the current 3,000 e.h.p. Napier Elands, and capable of carrying 65 passengers or 18,000 lb. of freight, is continuing.

The 5-6-seat Nimbus-engined P.531 Scout is in production for the British Army, and has completed evaluation trials with the Royal Navy. R.A.F. squadrons will soon be receiving the Gnome-engined Whirlwind Series 3, while in production for the R.A.F., and also on show in Paris, is the twin-Gazelle Belvedere. Three Belvedere squadrons are to be formed within No. 38 Group, Transport Command.

For the Royal Navy, the Gazelle-engined Wessex 1 is being produced for anti-submarine operations. It combines both detection and attack functions. In addition to hardware at the Show, Westland is also showing a model of the SR.N2 Hovercraft, a 66-passenger development, weighing 27 tons, of the original Hovercraft prototype which is continuing development trials. The SR.N2 now being built at Cowes should be ready by spring 1962. Four Blackburn A.129 gas-turbine engines developing 3,000 h.p. will drive two lifting fans and two swivelling propulsion propellers.

And now GNOMES FOR SWEDEN



The Gnome has been ordered in quantity to power the Vertol 107 and Agusta Bell 204B helicopters of the Swedish armed forces.

The Gnome is already in quantity production for the Ministry of Aviation's Whirlwind Mk.10 and Wessex 2 programmes and for the Italian Agusta 101 and Agusta Bell 204B helicopters.

DE HAVILLAND ENGINES

MEMBER COMPANY OF THE HAWKER SIDDELEY GROUP

CASTROL 98

GAS TURBINE OIL

now approved against

D.Eng.R.D.2487

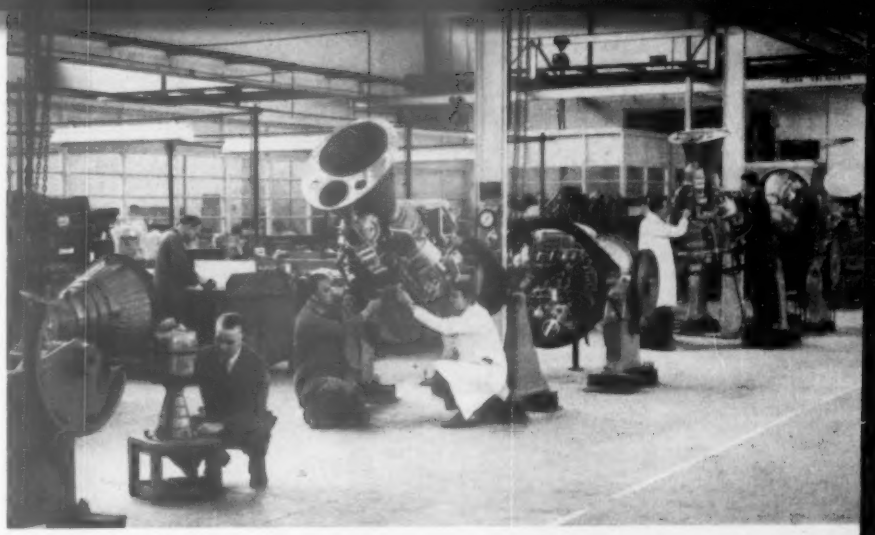
Intensive testing has proved the outstanding qualities of Castrol 98 Gas Turbine Oil. This has resulted in approval of the oil by the Ministry of Aviation against specification D.Eng.R.D.2487 (Nato Code No. 0-149, British Joint Services Nomenclature OX-38). Castrol Limited is the first and only British company to produce a synthetic oil to meet this specification.

CASTROL LIMITED, CASTROL HOUSE, MARYLEBONE ROAD, LONDON, N.W.1

Castrol
MOTOR OIL

At the Paris Salon . . . .

British Aero-engines on Show



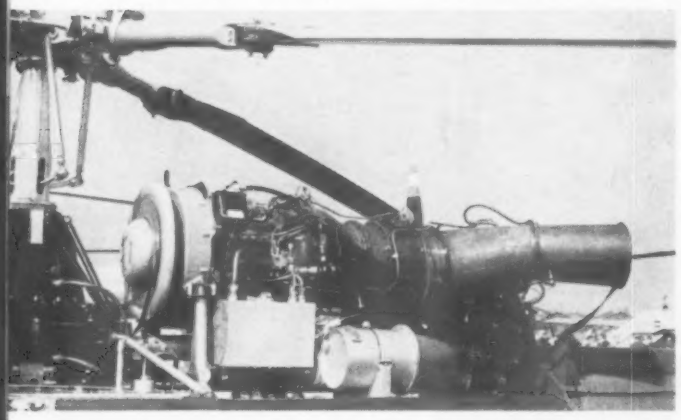
STENTOR.—The two-chamber Stentor is being produced by Bristol Siddeley for Avro Blue Steel air-to-surface missiles.

POWERPLANTS for aircraft ranging in size from club types to the largest jet airliners are being exhibited at Paris by members of the British aero-engine industry. Many of the engines on view have been adopted for non-British aircraft; not for nothing do aircraft powerplants account for 52% in value of the total aeronautical exports from the U.K.

Details of the exhibits are given below. Particularly significant is the new series of military and civil ducted-fan and by-pass engines exhibited by Bristol Siddeley and Rolls-Royce.

Blackburn Engines, Ltd.

This member of the Hawker Siddeley Group is exhibiting a 970-s.h.p. Nimbus free-turbine engine, in sectional form; an Artouste airborne auxiliary power unit of the type supplied for the Handley Page Victor 2 bomber and a Palouste low-pressure air starter pod of the type delivered to the Royal Navy.



NIMBUS.—Rated at 970 s.h.p., the Blackburn Nimbus free-turbine engine is the powerplant of the Westland Scout helicopter.

The Nimbus is in production for the Westland Scout helicopter which has been ordered by the British Army and Royal Navy. It was developed from the lower-powered Artouste free-turbine engine.

Blackburn is to supply airborne auxiliary power units for a range of British aircraft including the de Havilland Trident and Short Belfast. The company is developing a new unit of this type, the Cumulus, for a forthcoming British military aircraft. This new power unit is based on the earlier Palouste air-bleed gas turbine.

Bristol Siddeley Engines, Ltd.

Engine exhibits by Bristol Siddeley are a BS.53 Pegasus lift/thrust turbofan; Olympus, Orpheus and Viper turbojets; a Proteus turboprop; the Stentor and Gamma rocket engines; and a Thor ramjet.

The Pegasus is unique as the World's first lift/thrust turbofan for STOL and VTOL aircraft. The jet effluxes from its front fan and turbine exhausts are ducted to movable jet nozzles which direct the gas flow horizontally for propulsive thrust, vertically for lift thrust, or into intermediate positions for combinations of lift and thrust.

This engine delivers approximately 15,000 lb. of thrust. It has a high take-off thrust in relation to its cruising thrust and powers the Hawker P.1127, the first V/STOL aircraft designed for an operational rôle as a strike fighter. The Pegasus has been chosen for several VTOL aircraft projects.

Bristol Siddeley's Olympus turbojet on display is of unspecified mark and is fitted with a reheat system. An engine of this type has been chosen for the B.A.C. TSR-2 tactical strike and reconnaissance aircraft. An Olympus with Bristol Siddeley Solar fully variable reheat has given a maximum thrust of 33,000 lb. Olympus engines power all versions of the Avro Vulcan. The 17,000-lb. thrust Olympus 201 is the current production version of the engine; the Olympus 301 of 20,000 lb. thrust without reheat is also going into production.

The Orpheus 803 turbojet engine on view is of the type in production for the Fiat G.91; it has a thrust of 5,000 lb. Other versions of this engine power Gnat Trainers of the R.A.F. and Gnat fighters of the Indian and Finnish air forces. The most advanced Orpheus is the 6,810-lb. thrust BOr.12, which gives 8,170 lb. of thrust with a simplified reheat system. The Orpheus is built under licence in India, Italy and Germany.

The Viper ASV.11 turbojet has been developed from earlier versions of the engine installed in the Jindivik target drone and the Hunting Jet Provost service trainer. The ASV.11 powers the Macchi MB.326 trainer; Piaggio is to manufacture the engine under licence in Italy.

Of particular interest on the company's stand is a Proteus 705 that has been removed from a B.O.A.C. Britannia 102 after completing its full term of 2,400 hours between overhauls. The most advanced Proteus in service is the 765, which develops 4,400 e.h.p. for take-off.

A Gamma HTP/kerosene rocket motor of the type exhibited powers the Black Knight re-entry research vehicle; nine successful firings of this vehicle have been made to date. Thrust of the Gamma rises from 16,400 lb. at sea level to 19,000 lb. outside the atmosphere. The company is also showing a

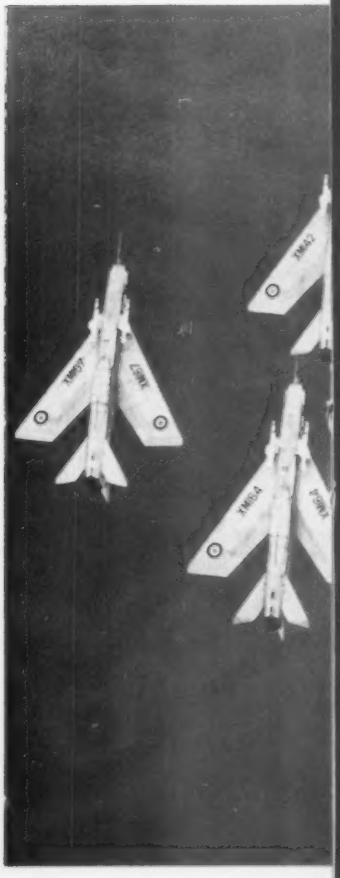
(*Continued on page 586*)

COUPLED GNOME.—Formed by coupling two 1,250 s.h.p. de Havilland Gnome engines, this unit will be the powerplant of the Westland Wessex 2 helicopter.

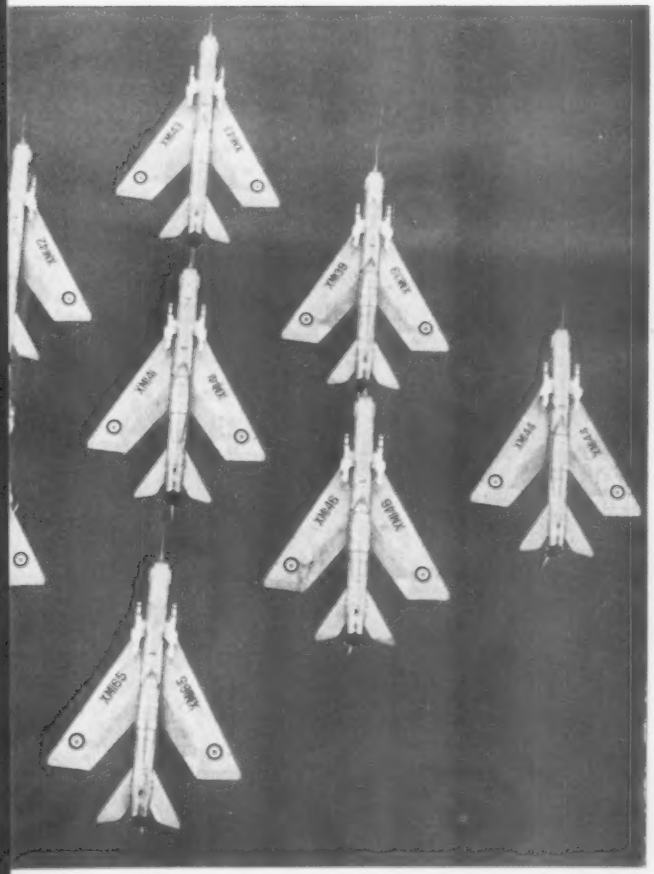
On Show at Paris . . . .

Left, the Commanding Officer of No. 74 "Tiger" Squadron, Squadron Leader J. F. G. Howe.

ROLLS

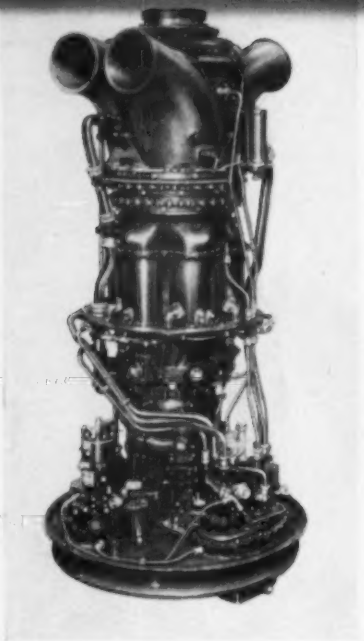


AND WINGOVERS



The highlight of the R.A.F. participation at the Paris Aero Show is to be formation flying by these English Electric Lightning F.1s of No. 74 Squadron from Coltishall. These photographs of individual and formation manoeuvres taken by THE AEROPLANE AND ASTRONAUTICS photographer Alfred Long show the "Tigers" working up for their display above the East Anglian countryside.

At the Paris Salon . . . .



GAZELLE.—Napier's 1,650-s.h.p. Gazelle free-turbine engine powers the Westland Wessex 1 and the Belvedere helicopters.

(*Continued from page 583*)

Stentor HTP/kerosene rocket motor of the type which powers the Avro Blue Steel stand-off bomb.

The ramjet exhibited is a Thor BT-1, an early version of the kerosene-fuelled ramjet which powers the Bristol Bloodhound surface-to-air missile. The BT-1 produces a thrust of 5,275 lb. at Mach 2.

The de Havilland Engine Co., Ltd.

Three versions of the de Havilland Gnome turboshaft engine are being exhibited by de Havilland Engines—a member company of the Hawker Siddeley Group. The Gnome is a licence-built version of the General Electric T58 free-turbine engine.

The Gnome H.1000 is a 1,050-s.h.p. engine which is in quantity production as a helicopter powerplant; it has been ordered by the British Ministry of Aviation and the Italian Agusta company. The de Havilland company also received recently an order worth more than £1 million for the supply of Gnome H.1200s to Sweden; they will power Boeing-Vertol 107s and Agusta Bell 204Bs for the Swedish Services. The H.1200 is an uprated version of the Gnome H.1000 and will deliver 1,250 s.h.p.

Other Gnome variants to be shown are the Gnome P.1000 turboprop and the Coupled Gnome H.1200 helicopter powerplant. The Gnome P.1000 has passed special-category ground tests and is approved for flight trials. An uprated version, the P.1200, develops 1,150 s.h.p.

As its name implies, the Coupled Gnome H.1200 consists of two H.1200s linked to a single gearbox to form a twin-engined unit. It is being developed under Ministry of Aviation contract to power the Westland Wessex 2 helicopter.

D. Napier and Son, Ltd.

Three of the British helicopters to be demonstrated at Paris are powered by Napier turboshaft engines. The Westland Wessex 1 and the twin-engined Belvedere both use the Gazelle 501 free-turbine engine, which has an emergency rating of 1,650 s.h.p. and a one-hour rating of 1,465 s.h.p., and the Rotodyne Y is powered by a special version of the Napier Eland. In its turboprop form this engine delivers 3,500 e.h.p.

Principal exhibits on the Napier stand are scale models of the Gazelle 501 and of the Gazelle 512, a version of the engine developed for helicopters in which all the reduction gearing is incorporated in the aircraft installation and power is taken direct from the free-turbine output shaft. Other exhibits are a model of a Wessex with material samples showing the effectiveness of Napier corrosion-protection treatments; models of military and civil Westland Belvederes, of the Eland turboprop, and of an Allegheny Airlines Convair 540. Specimens from the Napier investment foundry are also being shown.

On a separate stand Napier and their licensees are jointly sponsoring a display of the Napier Spraymat ice-protection system. Exhibits include the engine intake of a Lockheed Starfighter and Spraymat applications to helicopter rotor blades and Electra and Gannet components. There will also be examples of Sierracote on view; this transparent film heater for windscreens is made by Napier under licence.

Rolls-Royce, Ltd.

A wide range of turbojet, by-pass and piston engines is being exhibited this year by Rolls-Royce; the company is not, however, showing any of its turboprop engines. On view are the latest civil and military versions of the Avon, Conway and Spey by-pass engines, two RB.108 jet-lift engines, an RB.145 lightweight turbojet, and two Continental piston engines of the type to be built under licence by Rolls-Royce.

The civil Avon being shown is the RA.29/6 turbojet of 12,725 lb. thrust. This version of the civil Avon powers the Caravelle 6. The company is also showing an RB.146 military Avon of 12,220 lb. thrust with a reheat system which gives it an augmented thrust of 16,000 lb. In this form the engine is installed in the Dassault Avon Mirage IIIO. The same engine also powers the latest version of the Saab Draken, but in this case it has a Swedish reheat system.

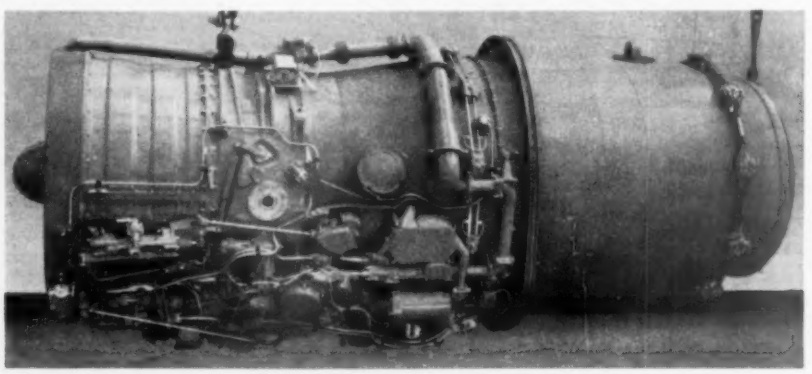
The Conway by-pass engine on display is an RCo.12 of 17,500 lb. thrust. It is similar to the Conways which power the Boeing 707-420 and Douglas DC-8 series 40 airliners.

For the first time in Paris, Rolls-Royce is displaying the RB.163-1 Spey by-pass engine. This by-pass type will power both the de Havilland Trident and British Aircraft Corporation One-Eleven airliners. Rolls-Royce also has a Ministry of Aviation contract covering the development of a military version of the Spey and the supply of prototype engines. The Spey will power the Blackburn Buccaneer 2.

The civil Spey has a guaranteed minimum take-off thrust of 9,850 lb. in sea-level I.S.A. conditions, and a cruising s.f.c. of 0.766 lb./lb./hr. at Mach 0.78 and 25,000 ft. altitude. Flight tests with two Speys mounted in a Vulcan will begin in August and engines will be supplied for the prototype Trident which is expected to make its maiden flight before the end of this year.

The company is exhibiting two of its RB.108 lightweight jet-lift engines mounted side-by-side. Vertical thrust for the Short SC.1 VTOL research aircraft is provided by two pairs of RB.108s. Each engine gives 2,010 lb. thrust and has a thrust/weight ratio of 8.1 : 1. Propulsive thrust for normal forward flight is provided by the fifth RB.108. Rolls-Royce is also showing an RB.145 lightweight jet engine of 2,750 lb. thrust.

Two Continental piston engines of the type to be made under licence by Rolls-Royce are also being exhibited. They are the 100-b.h.p. O-200-A and the 260-b.h.p. IO-470-D. These engines will be built by the Rolls-Royce Light Aircraft Engine Department at the company's Crewe factory.



SPEY.—Latest Rolls-Royce by-pass engine is the 9,850-lb. thrust Spey, which will power the de Havilland Trident and B.A.C. One-Eleven airliners and the Blackburn Buccaneer 2 strike aircraft.

DART
Herald

Pressurised civil or military jet-prop transports; 56 passengers or 6½ tons of freight or combinations of both at 275 m.p.h. for 850 miles; operates from 1000-yd. grass airstrips; built for long life and easy maintenance; penny-a-passenger-mile economy.

. . . a Herald cut one engine— and climbed another 500 feet

From Port Moresby in Papua a Dart Herald was flying at 12,500 feet on a proving flight—part of its tough see-it-in-action testing programme which has taken aircraft of this type nearly 200,000 miles around the world to 56 widely-differing countries.

A local airman challenged the Herald's pilot to cut an engine at that altitude. He did so and climbed another 500 feet for good measure—as proof of the Herald's capability on half its power.

Heralds are built by Handley Page to fly; to fly strongly and safely with power to spare. They are making light work of some of the most difficult flying conditions and airstrips anywhere.

Their fail-safe design, craftsmanship and Rolls-Royce Dart engines are guarantees of economy, versatility and safety.

Now at Handley Page's factories around London, production is apace on a first batch of 25 Heralds for service with Jersey Airlines, Maritime Central Airways, British European Airways, North-South, Nordair and other operators.

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G. Q. PARACHUTE CO LTD., STADIUM WORKS, WOKING, SURREY, ENGLAND.

At the Paris Salon . . . .

International Highlights

The Breguet Br.941 integral STOL transport—seen here immediately after its roll-out last month—is likely to be one of the most interesting aeroplanes at Paris this week and next.

FRANCE

Naturally enough the 24th Salon will be dominated by the exhibits of the French aircraft industry; these are of a quality unequalled in the seven post-War Paris Aero Shows, and probably in the entire series since 1909. Gone are the over-ambitious and under-developed prototypes of the early 'fifties; in their place are fighters, supersonic bombers, turbine transports, helicopters and light planes which, in their particular classes, must be counted among the finest in the World—and each one is a production article.

From the latest information available a week or so before the Salon opens, it is expected that some 35 French aircraft will be exhibited for part or all of the duration of the show. In addition to these, many home-built and older light aircraft are likely to appear on Light Aviation Day, May 27.

Notable among the French exhibits will be the Dassault aircraft, comprising a Mirage IIIC or possibly the prototype IIIE; the Etendard IVP Naval reconnaissance fighter; the Mirage IV-01 bomber prototype, the MD415 Communauté and possibly the prototype Mirage IIIO.

The Avon-Mirage, as we showed in a special article in our issue for Dec. 2, 1960, has been developed as an export version and the 16,000-lb.s.t. (with reheat) Avon 67 engine makes it one of the most potent weapons under development in Europe. An SEPR 841 rocket pack is an optional extra to obtain optimum performance at altitudes above 60,000 ft., but even without this aid the Avon-Mirage takes only a fraction over six minutes to reach 50,000 ft.

Dassault's Mirage IIIC, similar to the IIIO but powered by an Atar 9, benefits from the variable after-burner of the latter engine. It is in production for the Swiss Air Force, which has ordered 100, and the French Air Force which has ordered 150 interceptors and 320 of the later variants. These—details of which will be available from Dassault in the Exhibition Hall—include the IIIB two-seat trainer and the IIIE tactical support version.

Of the projected Armée de l'Air orders for the Mirage III, 270 are part of the "*loi de programme*"—a five-year plan to build up the French deterrent force (see our issue for Feb. 3, 1961). Also part of this programme is the order for 50 Mirage IV supersonic bombers which will have the primary responsibility for delivering the French nuclear weapons to their targets. The prototype Mirage IV—essentially a scaled-up Mirage III with two Atar 9C turbojets—was seen briefly at the previous Paris Salon on its second test flight; this year it appears with certain modifications including a shorter fin, ventral radome and, perhaps, a dummy weapon half-buried in the fuselage.

A third Dassault aeroplane in the "*loi de programme*" is the Etendard IV, 100 of which are being produced for service in the French aircraft carriers "Foch" and "Clemenceau." The example on show is the seventh and last of a pre-production batch, with a nose refuelling probe and cameras in a ventral pack. The final Dassault exhibit, the prototype Communauté twin-turboprop transport, is a reminder of the recently announced joint Sud-Dassault Diplomate (previously Super-Communauté) project, details of which will be available on the indoor stands.

Matching the Dassault exhibits in interest will be those by the Breguet company, with the STOL Br.941 expected to make an appearance early in its flight test programme. This aeroplane, and its smaller research predecessor Br.940 (also to be shown) was the subject of General Ziegler's Louis Blériot

Above, first flown on April 29, the Potez 840 is arousing interest as a potential executive aeroplane as well as a feeder-liner.

One of the several new lightplanes making their first appearance at Paris is the attractive four-seater Gardan Horizon.

Right, to lend point to their current campaign to sell a STOL version of the Hercules in Europe, Lockheed plan to exhibit the C-130C BLC prototype, with two YT56 engines under the wings to provide compressed air for the blown ailerons, flaps, rudder and elevators.

At the Paris Salon . . . .

paper given in London in March and reviewed in our issue for Mar. 30.

As one of the first attempts to produce a genuine commercial STOL transport it will be the subject of close scrutiny, as will the full-size mock-ups of the Br.941 and the pressurized Br.942 which are to be on permanent exhibit at le Bourget. Details of other members of the "94" family and of the Br.1100 Atlantic (see our issue for May 18, 1961) will be found on the Breguet stand, and an example of the anti-submarine Alize in Indian Navy colours in the aircraft park is a reminder of another French export success.

One of the outstanding French successes is, of course, the Caravelle, and this point will be brought home by the appearance of a Caravelle VIR (Rolls-Royce Avon engines) in United Airlines' colours, and the prototype Caravelle III/VII re-engined with General Electric CJ805-23 turbofans.

In the smaller turbine transport field the Max Holste Super Broussard and Potez 840 are both newcomers to the Paris Aero Show, although the piston-engined Super Broussard prototype appeared at the 23rd Salon. With two Bastan IV or V turboprops, the Super Broussard is being built and marketed by Nord Aviation, with the backing of the French Government. A little smaller, the Potez 840 (four Astazou turboprops) made its first flight on Apr. 29 and is arousing interest in the U.S. for executive use. A third aircraft in a similar general category is the Sipa S-272 Presence (two Astazou turboprops), of which a full-scale mock-up will be shown.

Turbomeca turboprops will be seen in action also in some of the SFERMA conversions, including the Nord 1101 (on which we published a handling assessment in our issue for March 23). A Beech Marquis (Baron conversion) with two Astazou turboprops and the Dornier Do 27T with a single Astazou are also expected to be shown.

In the light jet aircraft category, the four-seat Morane-Saulnier Paris II will be joined this year by the Potez-Heinkel CM191, developed from the Potez Air Fouga CM170 Magister and a living example of Franco-German collaboration in practice. On the lighter side, Morane-Saulnier will exhibit standard and "super" versions of the Rallye, the latter making its first appearance.

Also listed for exhibition are the Scintex ML 145 Rubis, Wassmer WA 40 Super IV, Gardan G.Y.80 Horizon; S.A.N. Ambassadeur; Jodel D.120 and Piel C.P.301C. Following a recent agreement between Sipa and the Italian Procaer company, Sipa will show the Procaer F15B, described as "the Ferrari of the air," and the Colra jet lightplane.

Among the French helicopters present, perhaps the most interesting is the full-scale mock-up of the Sud S.A.3210 Super Frelon. Developed from the three-engined Frelon which made its first public appearance at the previous Salon, the Super Frelon has amphibious characteristics similar to those of the Sikorsky S.61. The Frelon itself will be shown together with an Alouette III, latest variant of this best-selling utility helicopter, orders for which now total 750.

Exhibited by Fiat, this model illustrates one possible configuration for the G-95 STOL fighter project, with separate lift and thrust engines.

Extensive indoor displays will feature the latest Turbomeca and SNECMA engines, while the Hispano Suiza stand will include a Rolls-Royce Tyne 21, of the type to be built in France for the Breguet Atlantic and Transall C.160. The French ancillary industry also is responsible for the great majority of the indoor stands; the highlights of their displays will be reviewed in our next issue.

AMERICA

Indicative of the importance attached to the European market by the American aircraft industry (see our previous issue) is the extent of U.S. participation at Paris. Most of the leading aircraft companies will be represented, either by direct exhibits or through their European associates, and many will have their latest aircraft on show. Companies present include Aero Commander, Beech, Bell, Boeing, Cessna, Curtiss Wright, Del Mar, Douglas, Grumman, Hiller, Kaman, Lockheed, Martin, North American, Northrop, Republic and Sikorsky; the two major engine manufacturers, General Electric and Pratt & Whitney; and a number of ancillary companies including Bendix, Garrett, General Precision, Hughes, Lear and Pacair.

Among the new aircraft to be seen, particular interest will be aroused by the North American T-39 Sabreliner. In production for the U.S.A.F. as a proficiency trainer, the Sabreliner is the first example of the small, rear-engined jet transport concept which is now interesting the manufacturers of many countries. Another newcomer to Europe is the Grumman AO-1 Mohawk, the twin-turboprop Army observation aeroplane.

Northrop will describe, on their stand, their work in the field of boundary layer control and Lockheed will be making a major presentation of the BLC Hercules, scheduled to arrive at Le Bourget on May 25. Sikorsky will show a full-scale

AIRCRAFT AT PARIS

THE following provisional list of aircraft which are to be demonstrated in flight at the Paris Aero Show is based on information provided by the Union Syndicale des Industries Aeronautiques, and may not be complete. It excludes a number of types which will be shown only in the static aircraft park, and some types to be shown in the closing flying displays by Service teams from various countries.

LIGHTPLANES AND TOURING AIRCRAFT. Aeromere Falco; Beagle Airedale; Beech Bonanza; Breguet 905 and 906; Bolkow L.207; S.A.N. Ambassadeur; Cessna 172; Cessna 185; Cessna 210; Dornier Do.27; Gardan GY.80 Horizon; Morane Saulnier MS.880/885 Rallye; Piper PA.18; Piper PA.24 Comanche; Piper PA28 Cherokee; Procaer F.15B Picchio; Procaer F.400 Cobra; Rhein F.400 Multoplane; Scintex CP.301 Emeraude; Scintex ML.415 Rubis; Zlin 326.

GENERAL PURPOSE AND EXECUTIVE AIRCRAFT. Aero Commander 680F; Beech Baron; Beech Queen Air; Beech Twin Bonanza; Beech Super G.18S; Cessna 310F; Dornier Do.28; Dassault MD.415 Communaute; de Havilland Dove; Macchi-Lockheed LASA 60; Morane Saulnier M.S.760 Paris II, Morava 200; Pilatus Porter PC.6; Piper PA.23 Aztec; SFERMA Marquis; SFERMA Beech PD.18S; Simmering M.222.

HELICOPTERS. Aer Lualdi L.59; Agusta Bell 47G3; Agusta Bell 47J3; Agusta Bell 102; Agusta Bell 104; Agusta Bell 204B; Boeing Vertol 107; Hiller 12E.4; Hiller YROE-1 Rotorcycle; Sud Alouette II; Sud Alouette III; Sud Frelon; Sikorsky HSS-2; Westland Rotodyne; Westland Wessex; Westland Whirlwind; Westland Scout; Westland Belvedere.

CIVIL AND MILITARY TRANSPORTS. Antonov An-10; Antonov An-24; Armstrong Whitworth A.W.660 Argosy C.Mk.1; Avro 748; Breguet Br. 941; Handley Page Herald; de Havilland Heron; de Havilland Caribou; Max Holste Super Broussard; Lockheed C.130 B.L.C.; Nord 2501; Potez 840; Sud Caravelle VIR; Sud/G.E. Caravelle VII; Tupolev Tu-124.

MILITARY TRAINERS. Folland Gnat; Hawker Hunter; Macchi MB.326; North American T-39, Northrop T-38; Hunting Jet Provost; Potez CM.170 Magister.

RESEARCH AIRCRAFT. Breguet Br. 940; Nord 1500 Griffon II; Short S.C.1.

COMBAT AIRCRAFT. Avro Vulcan; Boeing B-52; Breguet Alize; Chance Vought F8U-2 Crusader; Convair B-58 Hustler; Convair F-106 Delta Dart; English Electric Lightning; Dassault Mystere IVA; Dassault Etendard IVM; Dassault Mirage IIIC; Dassault Mirage IIIO (Avon); Dassault Mirage IV; Handley Page Victor; Lockheed F-104 Starfighter; MacDonnell F4H-1 Phantom II; North American A3J-1 Vigilante; Republic F-105 Thunderchief; Vickers Scimitar.

mock-up of the S-64 Skycrane, in conjunction with Weser of Germany, which has the European production rights.

In addition to the individual manufacturer's exhibits, a massive entry is to be made by the U.S. Defense Department, including examples of U.S. record-breaking aircraft. This exhibit is expected to provide, for the first time in Europe, a Convair B-58 Hustler, North American A3J-1 Vigilante, McDonnell F4H-1 Phantom II, Republic F-105, Convair F-106, Sikorsky HSS-2, and Kaman H-43B Huskie. Missile exhibits will be related to the theme of peaceful space research, with various U.S. satellites on show, and NASA is expected to have full-scale mock-ups of the North American X-15 and Boeing Dyna-Soar.

General Electric will show the whole range of jet engines now under development, with a sectioned J79-11-A (F-104 power-plant); a full-scale model of the CJ-805-23 turbofan (Convair 990 and Caravelle VII engine); and mock-ups of the J85-GE-5 turbojet (Northrop T-38); the T-58 turboshaft; the T-64 turboprop; the CF-700 turbofan and the CJ-610 turbojet. The company is also developing lift fans for VTOL applications, with first flight tests in a converted conventional airframe expected by 1963; this work will be featured on the stand.

Pratt & Whitney, as part of the United Aircraft Corp. exhibit, will display a sectioned JT3D turbofan, a quarter-scale model JT3C-6 and mock-ups of the JT8D (a new turbofan for the Boeing 727 and Caravelle X), the J58 and the LR-115 liquid rocket motor. Canadian Pratt & Whitney will be represented by a sectioned model of the PT-6 turboprop which recently began its flight trials in the nose of a Beech 18. A JT4A powerplant will be featured on the SNECMA stand.

AUSTRIA

Simmering-Graz-Pauker, which company's M.222 Flamingo light twin was a surprise exhibit at the previous Salon, is again among the exhibitors. This year its contribution will be a new prototype of the four-seat M.222.

BELGIUM

A small group exhibit, by the Belgian aircraft industry, will illustrate the activities of A.C.E. Charleroi, Avions Fairey, Fabrique Nationale, Gebecoma, and SABCA, with particular emphasis on Belgian participation in the F-104 programme. A Fairey Tipsy Nipper is expected to be among the full-size aircraft displayed.

CANADA

Canadair, Ltd., has a booth on the airfield from which to disseminate information on its CL-41 jet trainer, the CL-44 turboprop freighter and the CF-104 Super Starfighter. It is hoped that a CL-44 will be present for some of the time.

CZECHOSLOVAKIA

Omnipol, the Czech export agency, is showing the L-200 Morava and has information available, in an airfield booth, on the latest products of the Czech aircraft industry. These include the L-300, a turboprop development of the Morava, and the HC-2 and HC-3 helicopters.

GERMANY

The major West German aircraft companies have grouped their participation under the auspices of the Bundesverband der Deutschen Luftfahrtindustrie. A single large indoor display will cover the activities of the following companies: B.M.W., Bolkow, Focke-Wulf, Hamburger Flugzeugbau, Heinkel, Henschel, Merchle, Messerschmitt, Rhein-Flugzeugbau, Sell-Hans und Kuchentechnik, Siebel, Siemens-Schuckertwerke, Weser and Techno-Chemie. Aircraft exhibits are expected to comprise the prototype Potez-Heinkel CM191, the Dornier Do 27 and Do 28, Bolkow 207, Siebel SIAT 222, and Rhein RW 3.

ITALY

In common with several other European exhibits, the Italian display is in group form and is under the auspices of the Associazioni Industrie Aeromissilistiche. Companies represented are Aerfer, Aer Lualdi, Agusta, Alfa Romeo, Fiat, Piaggio, Procaer and SIAI Marchetti. The Fiat display is one of the largest, with models of G.91 variants, the 7002 helicopter and the STOL/VTOL G-95. Although not necessarily representative of the latest Fiat thinking in the VTOL field, the G-95 model shows an aircraft with separate lift and thrust engines.

Italian aircraft on show include the Fiat G.91T, the two-seat training variant which made its first flight last year: and the Agusta-Bell 204B, Italian-built variant of the Bell HU-1B Iroquois with a de Havilland Gnome turbine, first flown on May 10. The first Macchi-built Lockheed LASA-60 may also be exhibited.

NETHERLANDS

Fokker continues its unbroken association with Paris Aero Shows since before the War, with an indoor stand, an airfield booth and a Friendship demonstrator in the flying display. Keynote of the exhibition will be new versions of the F-27—the long fuselage types, high-density layouts, STOL developments and improved performance attributable to weight growth. Fokker also has in the design stage, and may reveal at Paris, a short-haul jet transport project with two Bristol Siddeley BS75 turbofans.

RUSSIA

Information at present available indicates that Russia will exhibit the Antonov An-10 and An-24, and the Tupolev Tu-124. None of these has previously been shown at Paris and although the An-10 is well known, the An-24 and the Tu-124 will, if they appear, arouse great interest. Both were shown publicly in Moscow for the first time earlier this month.

The An-24, in the same class as the Handley Page Herald and Fokker Friendship, was then described as a 32-40 seater with a cruising speed of more than 310 m.p.h. and a range of 500-745 miles. Its take-off distance was given as 1,320-1,500 ft. The An-24 is destined for use on local routes in Russia.

The 44-60-seat Tu-124 is derived from the Tu-104, and is destined for short-medium range domestic and international operation. Powered by two Soloviev turbofans, it has what the Russians describe as "mechanization of the wing" which may include leading edge flaps, and an air brake under the fuselage.

SPAIN

Aerotechnica S.A. is alone among Spanish companies at Paris, with a display of its helicopter projects. These are derived from the early work of the French engineer Jean Cantineau, whose first helicopter appeared in the 1951 Salon in the Grand Palais. The range now includes the two-seat AC-12 and five-seat AC-14, in production for the Spanish Air Force, and the larger AC-21 with two Turbomeca Turmo III turboshaft engines.

SWEDEN

Principal feature of the Saab exhibit will be a model of the new Saab 105 twin-jet military trainer, details of which are to be released for the first time. Powered by two new Turbomeca turbofan engines, the 105, on which design work is well advanced, can seat five in an executive transport version or carry a substantial weapons load as a military trainer.

Saab will also show three types of automatic pilot and the BT 9 toss-bomb computer ordered by the French Navy for use in the Dassault Etendard IVM.

The Svenska Flygmotor exhibit will feature the Swedish-built Avon 300 for the Saab Draken, and rocket and ramjet engines which the company has developed.

SWITZERLAND

Pilatus Flugzeugwerke will again show the Porter utility aircraft, which first appeared at Paris four years ago. Details of an Artouste-powered version, first flown on May 2, will be available.

Russia is reported to be sending three turbine transports to Paris, of which the most interesting should be the turbofan-powered Tu-124.

At the Paris Salon . . . .

Rockets and Missiles from the U.K.

BRISTOL AEROJET, LTD.

A particularly interesting new exhibit will be a high-altitude research rocket which Bristol Aerojet have designed to a Meteorological Office specification. This 7-ft. 6-in. solid-propellent rocket is designed for launching from land or ships, and will be test-fired next year probably at South Uist or Aberporth. It will carry 10 lb. of air-temperature and pressure-measuring instruments to a height of 40 miles.

BRITISH AIRCRAFT CORPORATION

Pride of place in the outside exhibition will be taken by the English Electric Blue Water surface-to-surface missile which will be publicly displayed for the first time. It will be seen complete with its launcher/transporter.

This advanced, highly mobile, corps support missile is being developed for the Army and has also been entered for adoption by the North Atlantic Treaty Organization as a replacement for the Corporal surface-to-surface missile. It has full cross-country mobility and can be carried in the new Argosy transport aircraft. Approximate dimensions of the missile are: Length 25 ft.; body dia., 24 in.; wing span, 81 in.; and tail span, 77 in.

With its solid-propellent motor, the Blue Water can be kept for long periods at instant readiness under cover, and be brought into action to engage a target with the response time of a gun, using normal artillery procedures. These will be demonstrated throughout the Show by a British Army detachment from the Royal Artillery.

To engage a target the Blue Water fire unit, consisting of a computer in a small Land-Rover and a missile carried on a combined launcher and transporter mounted on a standard three-ton lorry, need be in the open for only 10 minutes. By the time the missile arrives on target, the firing position has been completely cleared and the computer has moved off to join up with another missile on its launcher, ready to engage a further target.

The original launcher can be rapidly returned for reloading, a procedure which is carried out swiftly under cover by artillery personnel using the launcher only.

Although performance figures are classified, it can be stated that the Blue Water system provides a commander in the field with a weapon which is unique in its flexibility of operation and accuracy. The inertial guidance system is self-checking during the final pre-launch test phase and its adjustment is carried out by artillery personnel after a minimum of special instruction. Repair in the field is by replacement of the faulty component, involving little extra equipment than that normally carried on the launcher.

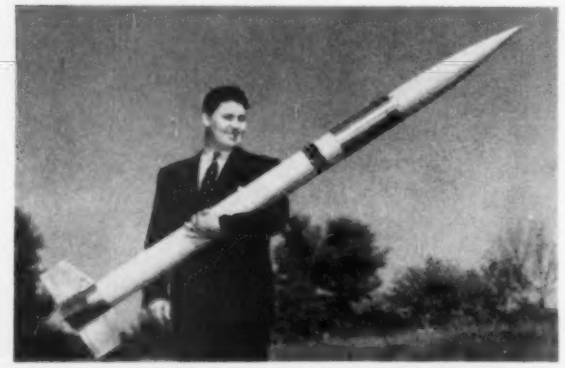
Alongside Blue Water in the outside display will be an Army battery of four English Electric Thunderbirds and vehicles; a Bristol-Ferranti Bloodhound; and a Ferret scout car with Vickers Vigilant anti-tank missiles. A Vigilant simulator will also be demonstrated at the Show.

In the exhibition hall, the B.A.C. stand will have a large-scale model of the Blue Water and, as the central feature, a panorama showing the operational aspects of the missile. There will also be models of the Thunderbird, Bloodhound and Vigilant.

FAIREY ENGINEERING, LTD.—WEAPON DIVISION

The two principal Fairey exhibits in this category will be the Malkara anti-tank missile and the Jindivik Mk. 2B high-performance target aircraft.

Malkara is the British Army's standard anti-tank guided weapon.



A full-scale model of the high-altitude meteorological rocket designed by Bristol Aerojet, Ltd. It is manufactured in in glass fibre and steel.

Features of the English Electric Blue Water are here seen to good advantage, with the 25 ft. missile in place on the zero-length launcher.

It is 6 ft. 5 in. long and weighs 216 lb., being propelled by a two-stage solid-propellent motor. The missile is wire-command guided from a point over 50 yd. from the launcher. Designed and developed in Australia by the Government Aircraft Factories, it is now in quantity production there; Fairey Engineering, Ltd., holds the sales rights throughout the World, excluding the U.S.A.

A new British Army launcher for the Malkara will be shown diagrammatically. This is a self-contained armoured fighting unit embodying four missiles which can be air-transported and parachuted into forward areas.

Similar sales rights are held by the Fairey company for Jindivik which was also designed, developed and manufactured by the Government Aircraft Factories in Australia. As well as catering for European sales, Fairey Engineering, Ltd., is responsible under contract to the Ministry of Aviation for introducing the Jindivik into service in the United Kingdom and for all modifications, conversions, repairs and maintenance.

In the outside aircraft park, a Jindivik Mk. 2B will be shown with a number of special trials aids including flare-heated sources for simulating the jet efflux of larger aircraft; Fairey microwave reflectors and transponders for enhancing radar acquisition; and jettisonable camera pods.

HAWKER SIDDELEY AVIATION, LTD.

Three types of missile are being shown by Hawker Siddeley Aviation—the A.W.A. Seaslug surface-to-air missile, a "representation" of the Avro Blue Steel stand-off bomb, and the de Havilland Firestreak air-to-air missile.

The Seaslug exhibit will be particularly comprehensive. It will include a combined display by the three main contractors, A.W.A., Sperry and G.E.C., featuring a full-scale sectioned Seaslug; a functional control ring section of the missile; complete and sectioned guidance receivers; functional shipborne control and guidance test equipment; a practical demonstration showing how beam-riding is achieved; and a range of sectioned components.

All these exhibits will be available for inspection on the Seaslug stand in the Hawker Siddeley Group enclosure. The stand itself will be dominated by a 30 ft. high triangular tower portraying various missile activities.

The Seaslug weapon system has been adopted by the Royal Navy and will equip its "Hampshire"-class guided missile destroyers. According to the Admiralty, "the system of operation has proved a great success" in extensive trials carried out from H.M.S. "Girdle Ness," the Royal Navy's trials ship. The vessel returned to Devonport in April after nearly two years in the Mediterranean.

Avro's Blue Steel is being developed for use in conjunction with the Vulcan B.2 as a means of increasing the striking power of R.A.F. Bomber Command prior to the introduction later in the decade, of the Douglas Skybolt ALBM. The "stand-off bomb" is powered by a Bristol Siddeley Stentor rocket engine employing HTP/kerosene.

De Havilland's IR-homing Firestreak is, of course, now well established with the R.A.F. and Royal Navy, forming the basic armament of the Gloster Javelin, the English Electric Lighting and the de Havilland Sea Vixen. There is still no official confirmation of its reported development, the Red Top.

SHORT BROTHERS AND HARLAND, LTD.

On the Short stand there will be a sectioned model of the Seacat surface-to-air missile and also a 1/10th scale model of a Seacat weapon system mounted on the deck of a destroyer, including the launcher, four missiles and a director. This missile is under development for the Royal Navy, the Royal Australian Navy, and the Royal New Zealand Navy. It has also been ordered by Sweden and Germany for evaluation.

The land-based variant of this short-range, command guided, solid-propellent anti-aircraft missile—the Tiger Cat—will also be represented at the Show.

Teddington in Paris

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At the Paris Salon . . . .

Rockets and Missiles from the U.K.

BRISTOL AEROJET, LTD.

A particularly interesting new exhibit will be a high-altitude research rocket which Bristol Aerojet have designed to a Meteorological Office specification. This 7-ft. 6-in. solid-propellent rocket is designed for launching from land or ships, and will be test-fired next year probably at South Uist or Aberporth. It will carry 10 lb. of air-temperature and pressure-measuring instruments to a height of 40 miles.

BRITISH AIRCRAFT CORPORATION

Pride of place in the outside exhibition will be taken by the English Electric Blue Water surface-to-surface missile which will be publicly displayed for the first time. It will be seen complete with its launcher/transporter.

This advanced, highly mobile, corps support missile is being developed for the Army and has also been entered for adoption by the North Atlantic Treaty Organization as a replacement for the Corporal surface-to-surface missile. It has full cross-country mobility and can be carried in the new Argosy transport aircraft. Approximate dimensions of the missile are: Length 25 ft.; body dia., 24 in.; wing span, 81 in.; and tail span, 77 in.

With its solid-propellent motor, the Blue Water can be kept for long periods at instant readiness under cover, and be brought into action to engage a target with the response time of a gun, using normal artillery procedures. These will be demonstrated throughout the Show by a British Army detachment from the Royal Artillery.

To engage a target the Blue Water fire unit, consisting of a computer in a small Land-Rover and a missile carried on a combined launcher and transporter mounted on a standard three-ton lorry, need be in the open for only 10 minutes. By the time the missile arrives on target, the firing position has been completely cleared and the computer has moved off to join up with another missile on its launcher, ready to engage a further target.

The original launcher can be rapidly returned for reloading, a procedure which is carried out swiftly under cover by artillery personnel using the launcher only.

Although performance figures are classified, it can be stated that the Blue Water system provides a commander in the field with a weapon which is unique in its flexibility of operation and accuracy. The inertial guidance system is self-checking during the final pre-launch test phase and its adjustment is carried out by artillery personnel after a minimum of special instruction. Repair in the field is by replacement of the faulty component, involving little extra equipment than that normally carried on the launcher.

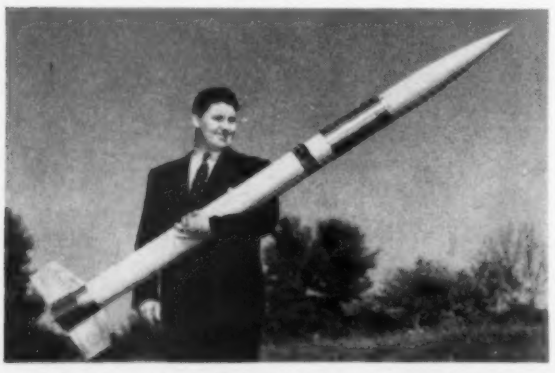
Alongside Blue Water in the outside display will be an Army battery of four English Electric Thunderbirds and vehicles; a Bristol-Ferranti Bloodhound; and a Ferret scout car with Vickers Vigilant anti-tank missiles. A Vigilant simulator will also be demonstrated at the Show.

In the exhibition hall, the B.A.C. stand will have a large-scale model of the Blue Water and, as the central feature, a panorama showing the operational aspects of the missile. There will also be models of the Thunderbird, Bloodhound and Vigilant.

FAIREY ENGINEERING, LTD.—WEAPON DIVISION

The two principal Fairey exhibits in this category will be the Malkara anti-tank missile and the Jindivik Mk. 2B high-performance target aircraft.

Malkara is the British Army's standard anti-tank guided weapon.



A full-scale model of the high-altitude meteorological rocket designed by Bristol Aerojet, Ltd. It is manufactured in in glass fibre and steel.

Features of the English Electric Blue Water are here seen to good advantage, with the 25 ft. missile in place on the zero-length launcher.

It is 6 ft. 5 in. long and weighs 216 lb., being propelled by a two-stage solid-propellent motor. The missile is wire-command guided from a point over 50 yd. from the launcher. Designed and developed in Australia by the Government Aircraft Factories, it is now in quantity production there; Fairey Engineering, Ltd., holds the sales rights throughout the World, excluding the U.S.A.

A new British Army launcher for the Malkara will be shown diagrammatically. This is a self-contained armoured fighting unit embodying four missiles which can be air-transported and parachuted into forward areas.

Similar sales rights are held by the Fairey company for Jindivik which was also designed, developed and manufactured by the Government Aircraft Factories in Australia. As well as catering for European sales, Fairey Engineering, Ltd., is responsible under contract to the Ministry of Aviation for introducing the Jindivik into service in the United Kingdom and for all modifications, conversions, repairs and maintenance.

In the outside aircraft park, a Jindivik Mk. 2B will be shown with a number of special trials aids including flare-heated sources for simulating the jet efflux of larger aircraft; Fairey microwave reflectors and transponders for enhancing radar acquisition; and jettisonable camera pods.

HAWKER SIDDELEY AVIATION, LTD.

Three types of missile are being shown by Hawker Siddeley Aviation—the A.W.A. Seaslug surface-to-air missile, a "representation" of the Avro Blue Steel stand-off bomb, and the de Havilland Firestreak air-to-air missile.

The Seaslug exhibit will be particularly comprehensive. It will include a combined display by the three main contractors, A.W.A., Sperry and G.E.C., featuring a full-scale sectioned Seaslug; a functional control ring section of the missile; complete and sectioned guidance receivers; functional shipborne control and guidance test equipment; a practical demonstration showing how beam-riding is achieved; and a range of sectioned components.

All these exhibits will be available for inspection on the Seaslug stand in the Hawker Siddeley Group enclosure. The stand itself will be dominated by a 30 ft. high triangular tower portraying various missile activities.

The Seaslug weapon system has been adopted by the Royal Navy and will equip its "Hampshire"-class guided missile destroyers. According to the Admiralty, "the system of operation has proved a great success" in extensive trials carried out from H.M.S. "Girdle Ness," the Royal Navy's trials ship. The vessel returned to Devonport in April after nearly two years in the Mediterranean.

Avro's Blue Steel is being developed for use in conjunction with the Vulcan B.2 as a means of increasing the striking power of R.A.F. Bomber Command prior to the introduction later in the decade, of the Douglas Skybolt ALBM. The "stand-off bomb" is powered by a Bristol Siddeley Stentor rocket engine employing HTP/kerosene.

De Havilland's IR-homing Firestreak is, of course, now well established with the R.A.F. and Royal Navy, forming the basic armament of the Gloster Javelin, the English Electric Lighting and the de Havilland Sea Vixen. There is still no official confirmation of its reported development, the Red Top.

SHORT BROTHERS AND HARLAND, LTD.

On the Short stand there will be a sectioned model of the Seacat surface-to-air missile and also a 1/10th scale model of a Seacat weapon system mounted on the deck of a destroyer, including the launcher, four missiles and a director. This missile is under development for the Royal Navy, the Royal Australian Navy, and the Royal New Zealand Navy. It has also been ordered by Sweden and Germany for evaluation.

The land-based variant of this short-range, command guided, solid-propellent anti-aircraft missile—the Tiger Cat—will also be represented at the Show.

Teddington in Paris

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Plessey Telecommunications equipment is employed on a world-wide basis by Civil Aviation Authorities; similarly, it is used internationally by Meteorological Services.

Behind this achievement are the extensive prototype and quality manufacturing resources of the Telecommunications Division, inspired by the work of a unique research and development organisation. The Company recognises the need to segregate advanced thinking from the hustle and distraction of the factory. Accordingly, in addition to the Group Research Laboratories at Roke Manor and other specialised research centres already existing in the U.K., extremely well equipped laboratories have recently been established at West Leigh for advanced Telecommunications studies.

In these establishments, the next generation of telecommunications equipment is already taking shape.

In close support at all times are the complete resources of the Plessey Group of Companies, which include unrivalled tool making and machining facilities, a full range of environmental testing and production laboratories, and the service of the metallurgical and chemical laboratories at Caswell.

Telecommunications Division · Electronic and Equipment Group
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At the Paris Salon . . . .

British Equipment and Accessories

A survey based on the latest list of exhibitors from the Salon authorities at the time of going to press.

A.E.I.

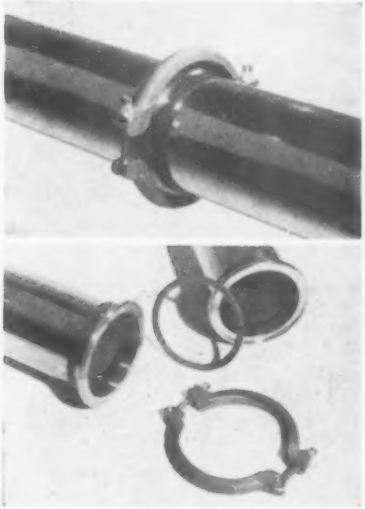
Forming part of the Sintex display, the main exhibits of Associated Electrical Industries, Ltd., consist of two diagrammatic layouts showing on the one hand the principal components of a constant-speed 400-cycle AC power system, and on the other the principal components of a variable-speed AC/DC power system. Also on show is a selection from the range of A.E.I. aircraft equipment including high-energy ignition units, switches, motors and an electronic ignition tester. This last-named unit can be used either on the ground or in flight, without disturbing the engine installation or electrically loading the magnets.

AVICA

The full range of piping and ducting system components designed and produced by Avica Equipment, Ltd., are exhibited on the stand of Société A.B.G., who are now Avica's licensee for certain of these components. This display includes the Type "W" range of metallic flexible pipes embodying welded-on couplings; a lightweight high-temperature "V" flange coupling for aircraft fuel and hot air systems; gimbal-type flexible joints for air ducting systems; and electrical harnesses and wiring assemblies.

B.A.C.

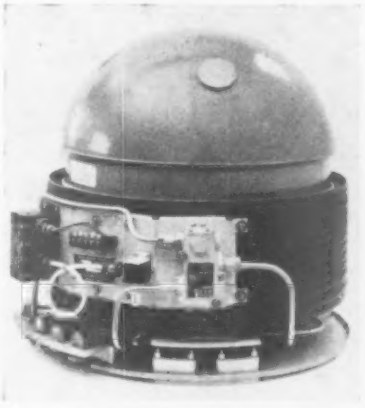
Divided into two sections, the British Aircraft Corporation's stand deals with the aircraft and missile activities of its member companies. In addition to a full-sectional "slice" of the Vickers One Eleven, with seating to show its five abreast capacity; models of such aircraft types as the Jet Provost, VC-10 and Super VC-10; and models of Blue Water, Thunderbird and Bloodhound missiles, the display includes instruments and components from the Bristol electronics section, together with gyroscopes manufactured by the English Electric instrument wing at Stevenage.



Avica lightweight high temperature "V" flange coupling for aircraft fuel and hot air systems.

BRISTOL AEROJET

Specialized techniques demonstrated by Bristol Aerojet, Ltd., include the production of thin wall tubes by helical welding of strip steel, titanium and other alloys, and the manufacture of lightweight high-pressure gas vessels. Examples of plastic rocket cones, nozzles, etc., in asbestos flock, together with a helically wound glass-fibre epoxy resin impregnated tube are also exhibited.



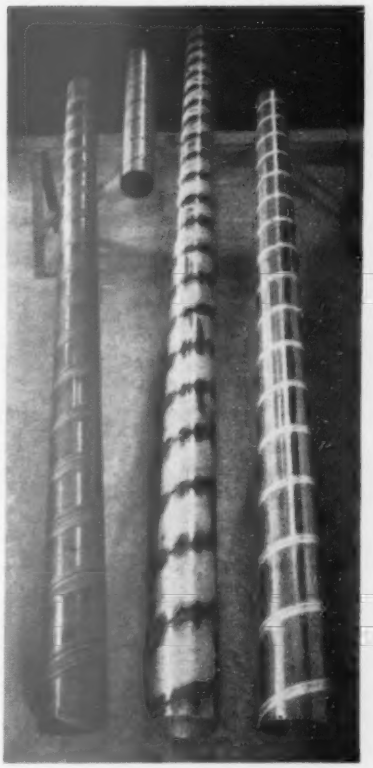
A 25-litre liquid oxygen converter developed by British Oxygen Aro Equipment, Ltd., for the Argosy C.1, the Belfast and the Comet 4C.

BELL'S

Exhibits on the stand of Bell's Asbestos and Engineering, Ltd., include numerous improved versions of established products which incorporate recently introduced synthetic materials, such as Viton "A" and "B" P.T.F.E. Of particular interest are fire-seals with silicone sponge cores and asbestos fabric covers for increased temperature and Skydrol resistance; silicone and glass-fibre connecting sleeves developed for air conditioning and de-icing systems; and silicone rubber fabricated components.

BRITISH OXYGEN

Aircraft breathing equipment, ranging from a 25-litre liquid oxygen converter package unit to a new portable oxygen breathing system for light aircraft is exhibited by British Oxygen Aro Equipment, Ltd. The 25-litre converter on display was developed for the Armstrong Whitworth Argosy C.1., the Short Belfast and de Havilland Comet 4C and is adaptable for other aircraft. It weighs 110 lb. when full and holds the equivalent of 22,000 litres of gaseous oxygen at N.T.P. Other converters on show are a 10-litre model, which weighs 41½ lb. full, and a 3½-litre unit (17½ lb. full).



Bristol Aerojet 5½ in. dia. helically welded tubes in aluminium, stainless-steel, titanium and steel.

The new B.O.A.E. portable oxygen breathing system, the Harlow Mk. 2, weighs 25 lb. and provides sufficient oxygen for four persons at 15,000 ft. for 2½ hr. It consists of a 750-litre oxygen storage cylinder, regulator, high-pressure charging valve, contents gauge and L-type masks.

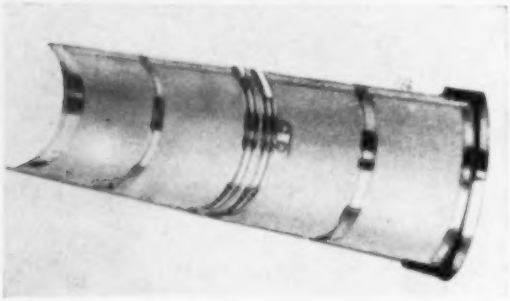
CIBA (A.R.L.)

Metal-to-metal bonding with Redux adhesives is the main theme of the display on the stand of CIBA (A.R.L.), Ltd. Aeroweb metal honeycomb core for lightweight aircraft structures is shown, together with completed sections of control surfaces, floorboards and other components incorporating this type of core. Information on the latest Hidux high-temperature adhesives is also available on the stand.

COSSOR

Exhibiting on the stand of C.T. (London), Ltd., Cossor Radar and Electronics, Ltd., are showing their Transponder Type SSR.1251, as recently ordered by Air France and Air India International for Boeing 707 turbojet transports. A scale model of the Cossor CR.787 mobile primary radar and a new type of low-cost radar reflector, the Icarus Mk. II, for meteorological use is also on display, together with some specialized strip transmission line components.

At the Paris Salon . . . .



A Delaney Gallay combined heat shield and high-temperature insulation blanket for the Lightning F.1.

DELANEY GALLAY

Typical examples of the company's high-temperature thermal insulation blankets are being shown on the stand of Delaney Gallay, Ltd. Also on display is a fully insulated thrust reverser; and a heat shroud for the Lightning. This last item, their latest development, has a dual-purpose construction combining several blankets and a heat shield in an integral unit. A selection of oil coolers in light alloy and stainless steel, including the latest high-density tubular coolers, and stainless-steel fabrications using argon-arc welding and vacuum brazing techniques are also being shown on the Delaney Gallay stand.

DOWTY

Four companies within the Dowty Group are represented at the show. Dowty Rotol, Ltd., are displaying a typical example from their range of turbo-fans, now being developed for the stability control of VTOL aircraft; electro-hydraulic servo valves; complete packaged flying control units; a Dowty-Moog valve controlled hydraulic actuator; and engine r.p.m. synchronisers. Dowty Fuel Systems, Ltd., are exhibiting fuel systems and components for the Bristol Siddeley BS.53 ducted fan engine, the Rolls-Royce RB.145 and 153 turbo-jets, and the de Havilland Gyron Junior.

DUNLOP

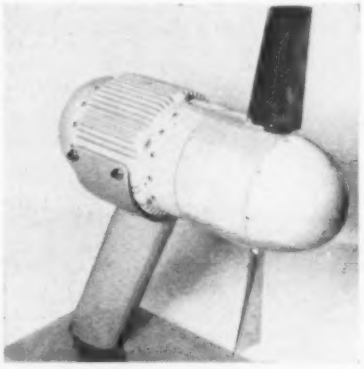
The Dunlop Rubber Co., Ltd., feature on their stand a variety of aircraft accessory equipment ranging from de-icing units to complete tyre, wheel and brake assemblies. A display of airborne and ground equipment includes a model of a new aircraft arrester gear for aerodrome installation. Dunlop are manufacturing components for this installation which consists of a cable between two energy absorbing units each incorporating a Dunlop high-energy multi-disc rotary friction brake, and a Maxaret control unit.

E.M.O. INSTRUMENTATION

Three units for checking and cleaning precision bearings — a torque-testing instrument for measuring their starting and running torques; a bearing washing machine and a bearing "smoothrator" for predicting their performance qualities —are being shown by E.M.O. Instrumentation, Ltd. Precision bearings for use in gyro flight instruments, computers, servo motors, etc., are also exhibited by this company.

EKCO

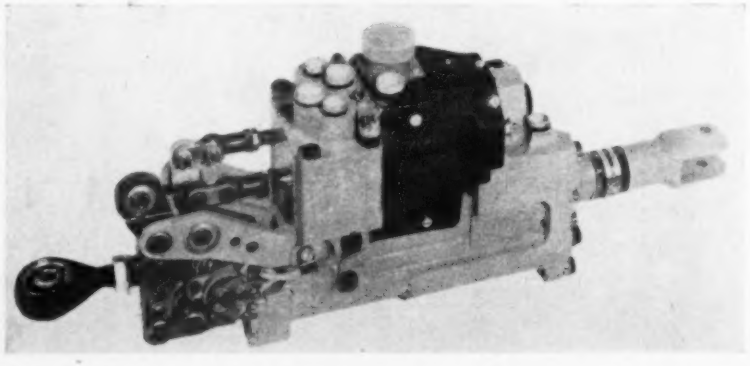
European Air Services are featuring navigational aids produced by Ekco Electronics, Ltd. These include the company's Type E.190 lightweight airborne weather radar and the Type CE.178 automatic VHF direction finding equipment.



An emergency power ram air turbine developed by Dowty Rotol, Ltd.

FAIREY

In addition to a Jindivik 2B target aircraft with special trials aids and Malkara anti-tank weapon equipment, the exhibits of the Fairey Group include the Del Mar RADOP towed target system for air-to-air and surface-to-air weapon training and hydraulic power controls for several different aircraft. The aerial survey techniques and equipment of Fairey Air Surveys are illustrated; and the display includes a fire-fighting suit in aluminized asbestos and other emergency apparatus made by Siebe, Gorman and Co., Ltd.



A Fairey hydraulic power control unit which can accept manual input commands from the pilot and also meet the demands of an automatic stabilising computing system.

FERRANTI

Two of the main exhibits on the stand of Ferranti, Ltd., are Airpass Mk. I and the company's integrated strike and interceptor system (I.S.I.S.) designed for light ground-support fighters such as the Fiat G.91. The Ferranti Aircraft Equipment Division is showing the T.R.500 transistorized transformer/rectifier that is installed in the Vickers Vanguard; the type F.S.16 vertical reference gyro for operation with remote indicating flight instruments; an F.H.7 Series standby artificial horizon; and a standby directional gyro system. The company's Electronics Division is showing a wide range of silicon semi-conductor devices.

GODFREY

Sir George Godfrey and Partners, Ltd., have on display a screw-type cabin air compressor incorporating a slide valve to maintain a constant mass flow of air to an aircraft air conditioning system at all altitudes. The company is also showing a VCP-1 Mk. 2 vapour cycle cooling package for maintaining the temperature of airborne electronic equipment within operational limitations; and a turbine-driven 30-kVA alternator. A recent addition to Godfrey products is a mechanical torquemeter which provides continuous readings from 0 to 850 lb. ft. in the 0-25,000 r.p.m. speed range.

GRAVINER

Airborne fire-protection equipment exhibited by the Graviner Manufacturing Co., Ltd., includes a compact lightweight smoke detector; a miniature smoke viewer capable of monitoring up to five compartments; an hermetically sealed detector; and a standard Firewire detector with improved accessories and control units. Bromotri-, B.C.F.- and C.B.-filled extinguishers and associated pressure relief indicators; heavy landing indicators and fuel-tank explosion protection equipment is also to be seen on this stand.

HANDLEY PAGE

Although not taking space in the main exhibition hall, Handley Page, Ltd., have a tented bureau on the airfield. In this the company have small displays featuring their Herald and Victor aircraft and their research work into laminar-flow techniques and projects.

HAWKER SIDDELEY

Ancillary equipment shown on the Hawker Siddeley Group stand includes a series of aircraft refuel/defuel couplings recently introduced by Armstrong Whitworth Equipment, together with the

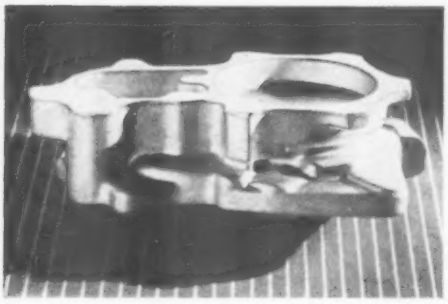
company's flight deck temperature control system and automatic pitch stabilizing components for aircraft. Folland are exhibiting their Mk. 4 ejection seat; and de Havilland have their propeller and spinner assembly for the Breguet Atlantic, and a Gnome turboshaft fuel control unit on display.

HIGH DUTY ALLOYS

On show on this stand are many of the aluminium-alloy forgings which High Duty Alloys, Ltd., manufacture for Continental aircraft constructors. These include undercarriage forgings produced by special techniques such as reverse flow, split or totally enclosed dies, and forgings in nickel, titanium and steel alloys. A stretch-form component in Hiduminium R.R.58 high-temperature aluminium alloy and an Avon turbojet fairing are also amongst the H.D.A. exhibits.

HOBSON

Exhibits on the stand of H. M. Hobson, Ltd., include a tandem piston jack used in the operation of the Sea Vixen's all-moving tailplane; a tri-axis feel simulator unit for the Vickers VC10; a hydraulically operated camber flap control for the Caravelle; fuel flow proportioners; a constant-speed alternator drive; and an electro-hydraulic actuator. A number of motor-pump and constant-pressure pump units are also displayed.



This end frame for a Viscount feathering pump motor is an example of a split die forging produced in Hiduminium 66 aluminium alloy by High Duty Alloys.

I.C.I.

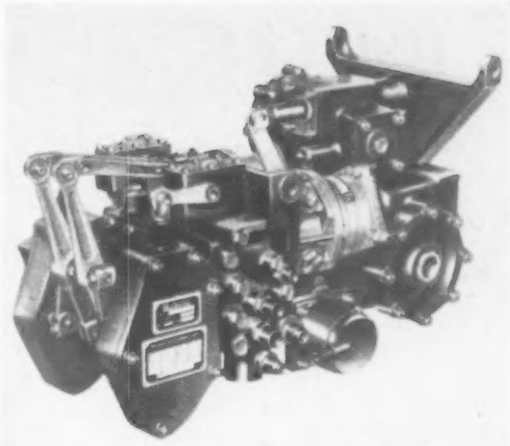
Exhibiting for the first time at Paris the I.C.I. Metals Division is drawing attention to the extensive and expanding use of its titanium in the aircraft industry. The exhibits are designed to show how readily various fabrication techniques, such as welding, forging, machining and forming, are applied to titanium and its alloys. Particular attention is devoted to heat-treatable alloys which can be formed in the soft, solution-treated condition and subsequently aged to achieve much higher strengths.

LODGE

Aircraft sparking plugs, turbine igniters and thermocouples, and Sintox engineering ceramics, are to be seen on the stand of Lodge Plugs, Ltd.

LUCAS

On the stand of Lucas Gas Turbine Equipment, Ltd., the exhibits have been grouped to show the company's full range of gas turbine fuel systems and combustion equipment on various aircraft. The most interesting of these items is the chassis-mounted fuel system designed for two-shaft turbojet applications such as the Bristol Siddeley Olympus. Other units include an equi-velocity system combustion chamber for providing a uniform exit velocity from a turbine compressor; a hydraulically driven fuel boost pump designed to supply fuel to the engine H.P. pumps under all conditions of flight; and the Lucas P.750 aircraft hydraulic pump.



The Hobson type 377 twin flap control for the D.H. Trident.

MARCONI

Equipment displayed on the stand of Marconi's Wireless Telegraph Co., Ltd., includes a selection from the company's Sixty Series range of airborne communications and navigation aids. Introduced at the 1960 S.B.A.C. Show, this equipment has been specified by B.O.A.C. for its VC10 fleet. Another exhibit is the type BD871 closed-circuit television camera channel suitable for air and ground applications such as the visual transmission of A.T.C. data.

MARTIN-BAKER

The most interesting item in the Martin-Baker Aircraft Co., Ltd., display—which forms part of the Hispano-Suiza Group exhibit—is the prototype rocket-assisted "zero-zero" ejection seat for VTOL aircraft. The company hope to demonstrate the capabilities of this seat from a ground rig mounted on a lorry and using a dummy subject, during the flying programme on Jne. 3-4. Two other Martin-Baker seats, a Mk. AM4, manufactured in France, and a Mk. H5 are also exhibited.

MECHANISM

Instruments displayed by Mechanism, Ltd., include a servo-operated barometer, which incorporates its own transistorized power pack; a fatigue meter with eight counting levels and an external transit lock; a transmitting and indicating accelerometer; and a differential pressure recorder for logging the fatigue history of a pressurized cabin. The company is also showing an altitude warning unit designed to prevent the misreading of the conventional three-pointer altimeter.

MICROCELL

(See "Paris Stop Press," p. 575).

MURPHY

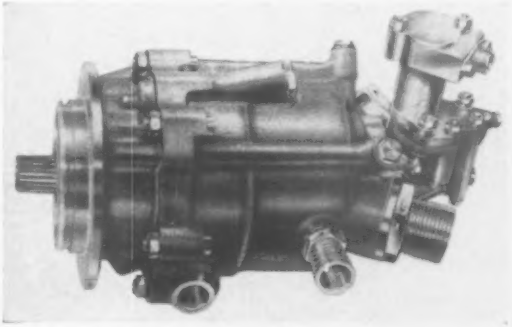
Two aids for navigation and automatic landing are exhibited by Murphy Radio, Ltd. The first, a low-power radar beacon, is a portable transponder suitable for use with any of the current types of Rebecca airborne units. It has been designed as a replacement to Eureka 2 to provide a local airfield homing beacon. The second item is the company's aircraft leader cable equipment for providing azimuth guidance for automatic landing.

NAPIER

In addition to their engine exhibits, D. Napier and Son, Ltd., are featuring the Spraymat ice protection system in conjunction with their Spraymat licensees. The centre-piece of the stand is the intake of a Lockheed Starfighter to which the system has been applied. Examples of Sierracote transparent film heater for aircraft windscreens are also exhibited.

NORMALAIR

Displayed on this stand is a range of pressurization, air conditioning and oxygen breathing equipment illustrating the wide scope of the activities of Normalair, Ltd. The centre-piece of the exhibit is an animated Perspex model of the cabin air compressor which forms one of the major components of the company's pressurization and air conditioning



Typical of the exhibits on the Lucas Gas Turbine Equipment stand is this type P.750 high-capacity variable-stroke aircraft hydraulic pump.

At the Paris Salon . . . .

systems for the Weser-Nord Transall C.160 military transport. Other items include the pressure control system, vapour cycle cooling equipment, and the liquid oxygen storage equipment, designed for the Vickers VC10.

PALMER AERO PRODUCTS

(See " Paris Stop Press," p. 575.)

PLESSEY

Plessey International, Ltd., are exhibiting aircraft electrical and telecommunications equipment, wiring and electrical connectors, and mechanical units. The 120-kVA. generation system for the Vickers VC10 is featured, together with static inverters and a fully tropicalized AC rotary geared motor unit. Other exhibits include a new constant-speed drive/starter unit for gas turbines; the liquid fuel starting system for the English Electric Lightning; aircraft actuators; fuel and hydraulic pumps; the Plessey PTR.170 UHF lightweight transmitter/receiver for military aircraft; and the AN/ARC 52 radio equipment manufactured under licence from Collins Radio.

PULLEN

The Motor and Servo Component Division of R. B. Pullen and Co., Ltd., are exhibiting on the stand of G. Walton, Ltd. The display includes DC motors; AC motors and motor generators; synchros and resolvers; servo gearboxes, and servo amplifiers.

R.F.D.

From its range of liferafts designed to suit airline specifications for either internal valise or wing pan stowage, the R.F.D. Co., Ltd., is spotlighting its fully equipped 26-seat Universal raft. The company, whose stand is situated in the outside static display, is also featuring inflatable lifejackets.

ROTAX

The display on this stand of Rotax, Ltd., is grouped to show complete generating and starting systems and electric actuation on various aircraft. On separate panels covering basic aircraft types such as civil turbojets and turboprops, jet bombers, missiles and helicopters, the equipment includes 15-45 kVA. solid rotor alternators; a range of low-pressure air starters for such engines as the Rolls-Royce Conway and Tyne together with a small combustor to supply low-pressure air to operate the starters; transistorized inverters; cyclic timers; and static switches.

ROYSTON

Highlight of the Midas maintenance and flight recording systems exhibited by Royston Instruments, Ltd., is the CMM.400/7D/60 recorder intended for civil airline use. In addition to this equipment which will record 270 parameters together with G.M.T., date, aircraft, flight and stage numbers, there is the CMM.400/7 ejectable recorder, the CMM.400/7C flight testing recorder, and the company's Midas LMC/U playback equipment.

SAVAGE

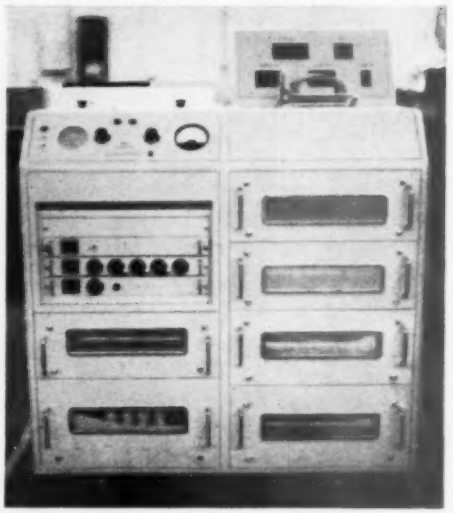
Exhibiting in conjunction with their French agents, Exchanges Techniques Internationaux, W. Bryan Savage, Ltd., are showing their type X.1001 moving coil vibrator giving ± 3,000 lb. thrust. In the Savage display, too, is a DC stabilized power supply unit, type STAB. 1001, for use with the V.1001 vibrator; a type 10L 10-kW. low-frequency amplifier for driving large vibrators; and a control console.

SHORT BROTHERS

In addition to the SC.1, and models of the Belfast freighter and Skyvan light freighter, Short Brothers and Harland, Ltd., are showing a scale model of an airport terminal incorporating their freight handling system. Designed to speed the loading and unloading of the Belfast and other large freighters, this system uses powered roller conveyors to feed loaded pallets directly in and out of the aircraft hold.

SPERRY

The Sperry Gyroscope Co., Ltd., is represented by its new company, Sperry Europe Continental. Exhibits cover reference gyros, including a twin gyro platform and the C.11 azimuth gyro; examples of integrated instrument systems; and the SP.3 and SP.40 gyro pilots. In addition, the company is represented on the combined Seaslug missile contractors' stand located in the Hawker Siddeley Group enclosure.



A recent addition to the Royston Instruments Midas range of flight maintenance recording systems is this LMC/U playback equipment.

STANDARD TELEPHONES

Sharing a stand with some of its European associate companies, Standard Telephones and Cables, Ltd., is exhibiting airborne VHF, ILS/VOR receiver equipment, an aircraft intercom system, and two frequency-modulated radio altimeters, one of which is designed for autoflare and autoland applications. The STAN/7.8.9. ILS; commutated antenna direction finders; and test units are also depicted.

TEDDINGTON

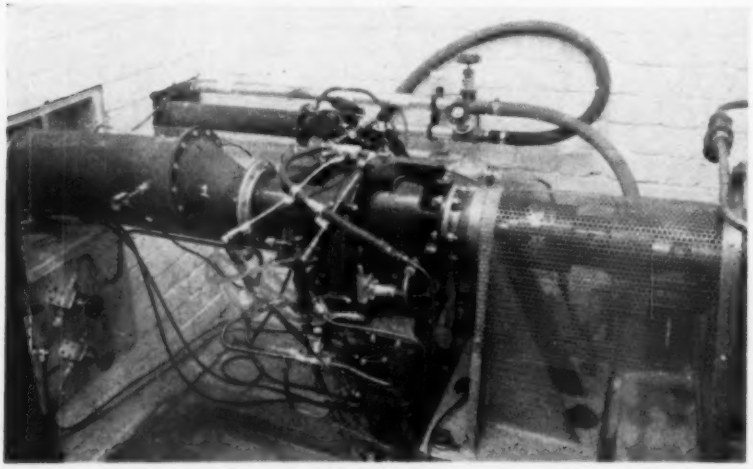
Arranged in conjunction with the company's French agents, Société Anonyme A.B.G., the Teddington Aircraft Controls, Ltd., display covers a wide range of instruments. These include control and pressurization valves for hot air, gas and fuel systems; ice detectors and warning units, including de-icing switches; cabin temperature control equipment used on the Breguet 1150; and individual temperature measuring instruments.

ULTRA

Ultra Electronics, Ltd., are displaying engine control and aircraft intercom equipment. Exhibits include the UE 91 engine condition analyser; the UE 920 engine vibration indicator; turbine speed and jet pipe temperature control amplifiers; and rotation and temperature streak detectors. The UA 60 communication control system and examples of SARAH equipment are also on show at the Salon.

VACTRIC

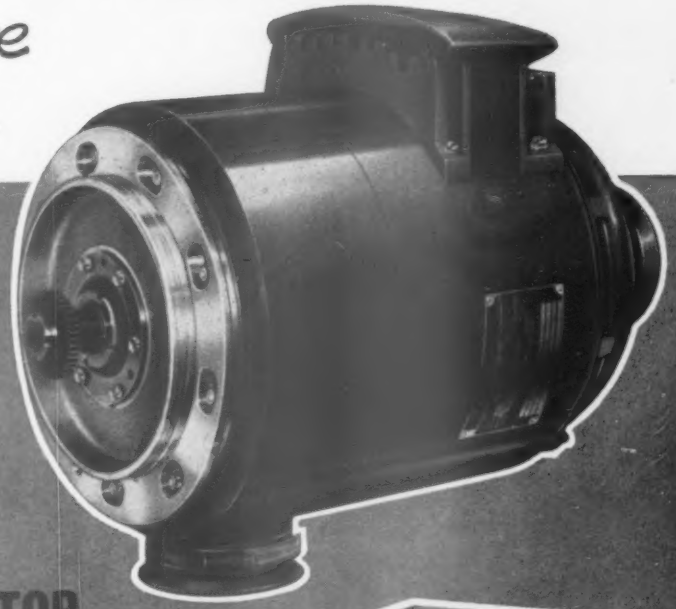
A comprehensive selection from their range of precision servo components is being shown by Vactric (Control Equipment), Ltd. These include AC motors and motor tacho-generators; permanent and split-field DC motors; DC tacho-generators, and rotary sampling switches.



A Normalair cabin air compressor for the Transall C.160 on test.

NO OTHER GENERATING SYSTEM

can compare with this....



55 kVA

BRUSHLESS A.C. GENERATOR with COMBINED REGULATOR and CONTROL PANEL

....for

- *low weight*
- *fast response*
- *reserve load capacity*

This advance in generating systems designed by 'ENGLISH ELECTRIC' has no equal. It comprises a variable speed, 55 kVA, brushless, air-cooled A.C. Generator with *single-unit* static control gear employing printed circuits, and demonstrates the superiority of 'ENGLISH ELECTRIC' rotating rectifier type main A.C. generating systems.

Voltage	200V, 3 phase
Output	55 kVA at 0.95 p.f
Overload rating (1 min.)	80 kVA at 0.95p.f.
Speed range	6500-9800 r.p.m.
Frequency	325-490 c/s
Weight	Generator 98 lb.
	Control Gear 13½ lb.

AIRCRAFT EQUIPMENT DIVISION
PHOENIX WORKS, BRADFORD

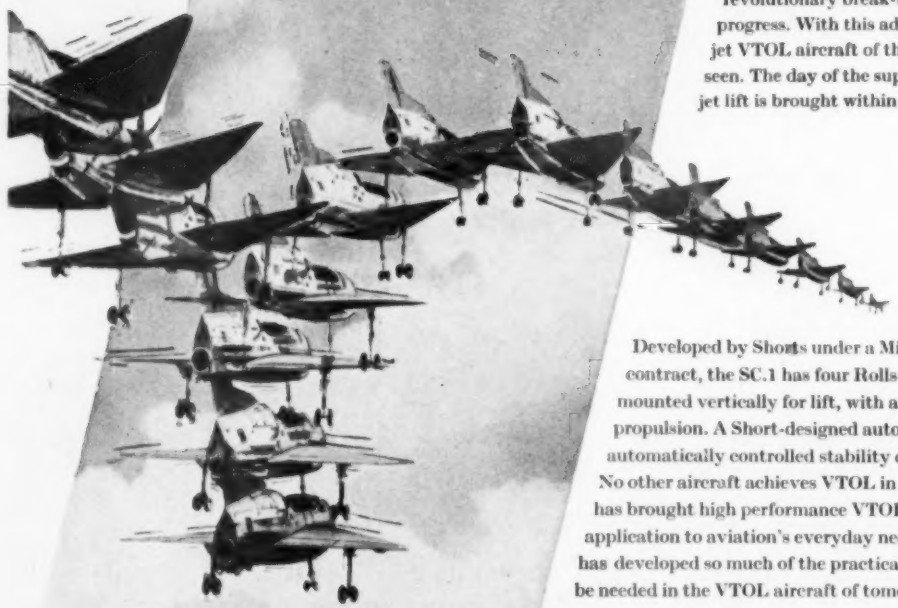
The English Electric Company Limited,
English Electric House, Strand, London, W.C.2.

'ENGLISH ELECTRIC'
aircraft equipment

AE.54

The *Short* SC.1 goes forward

Successful transitions by the Short SC.1 VTOL aircraft from jet-borne hovering to wing-borne forward flight and vice versa mark a revolutionary break-through in aeronautical progress. With this advance the way to the pure jet VTOL aircraft of the future can be clearly seen. The day of the supersonic civil airliner using jet lift is brought within reach.



Developed by Shorts under a Ministry of Aviation research contract, the SC.1 has four Rolls-Royce RB.108 jet engines mounted vertically for lift, with a fifth at the tail for propulsion. A Short-designed auto-stabiliser system gives automatically controlled stability during hovering and transition. No other aircraft achieves VTOL in this way. No other aircraft has brought high performance VTOL to the stage of immediate application to aviation's everyday needs. And no other team has developed so much of the practical equipment which will be needed in the VTOL aircraft of tomorrow.

SHORT BROTHERS & HARLAND LIMITED

Queens Island Belfast Northern Ireland

The first manufacturers of aircraft in the world

D.H.125 Jet Dragon

DE HAVILLAND have named their new six-seat executive aircraft the Jet Dragon. Powered by two Bristol Siddeley Viper 20 turbojets, it will, to quote de Havilland, "be built to meet the demands of the business executive for much higher standards of speed and comfort, while keeping the operating costs of a well-utilized aeroplane down to a level comparable with today's aircraft of the same size. It will provide World-wide travel at 500 miles an hour."

The aircraft has been named the Dragon in honour of the DH.84 of 1932, which was the company's first twin-engined transport. It will be called the Jet Dragon until the time when the adjective will be thought to have become needless. De Havilland have been test-flying jet aircraft at Hatfield for no less than 19 of the 30 years that have passed since the original Dragon took the air at Stag Lane on Nov. 24, 1932.

Announcement of the decision to build the Jet Dragon was made on Apr. 6 by Hawker Siddeley Aviation, of which de Havilland Aircraft is a member company. Production will follow direct from the design stage. An initial batch of 30 aircraft is to be built, with provision for quick expansion after the first batch. Deliveries will begin in 1963.

The new aircraft, which is well suited to occupy technical staffs who have been responsible for the Comet and the Trident jet airliners, will benefit from the research which went into the Trident design. Backed by Hawker Siddeley resources and a World-wide marketing and servicing organization, de Havilland are admirably placed to meet the needs of executive operators everywhere.

De Havilland regard the Jet Dragon as a long-term project. It is a private venture involving an investment of several million pounds in a type which may well remain in current service for 20 years. The company has considerable experience with multi-engined business aircraft; in the Jet Dragon this is combined with the extensive knowledge of turbojet air transport which the company has gained.

The Jet Dragon results from long and detailed research into market requirements. Powered by two rear-mounted Viper 20 engines each of 3,000 lb. thrust, it will carry six passengers and baggage with two crew. It will cruise at 450 to 500 m.p.h. over stages (with reserves) of some 1,500 statute miles. It is designed to operate from short runways and to have very moderate approach speeds and excellent handling characteristics at high and low speeds.

The large unobstructed cabin is fully pressurized and air conditioned. The wings, fin and tailplane will be de-iced. Provision will be made for the installation of complete navigation and radio equipment so that airline standards of regularity and punctuality can be maintained.

The spacious cabin of the Jet Dragon will be 18 ft. 6 in. long, 5 ft. 10 in. wide and will have 5 ft. 9 in. of headroom. There is ample room for six large executive armchairs with an aisle of generous width which leads aft to a cloakroom and lavatory with wardrobe and forward to the entrance vestibule, where space is available for a food and drink cabinet and a cupboard for coats or baggage. The floor of the vestibule is only 40 in. above ground level and the aircraft can be fitted with air-stairs. Non-structural and removable bulkheads separate the vestibule from the flight deck and from the cabin.

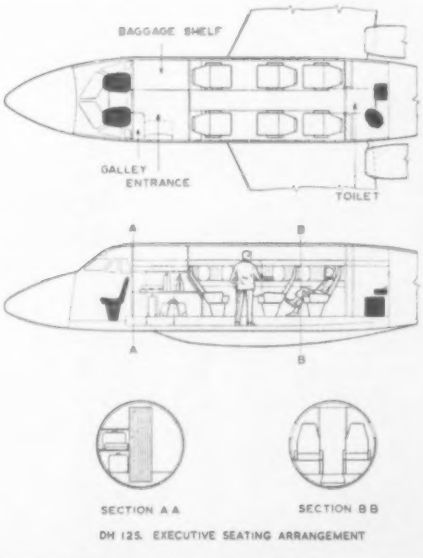
Structure and systems of the Jet Dragon have been kept simple to ensure reliability and good serviceability. Its maximum cruising speed will not greatly exceed Mach 0.7, thus avoiding such requirements as power controls.

The fuselage will be built in one piece, parallel over most of its length and with an uninterrupted circular cross-section. The wing will also be built as a single unit from tip to tip, passing unbroken beneath the fuselage. Combined with its low aspect ratio and relatively deep section, this will give an unusually light and stiff structure.

The fuselage will rest on the wing centre-section, the top surface of which is dished to receive it. There will be no abrupt discontinuity of section in either the wing or the fuselage, giving an assembly which will combine ease of production with lightness and great natural strength.

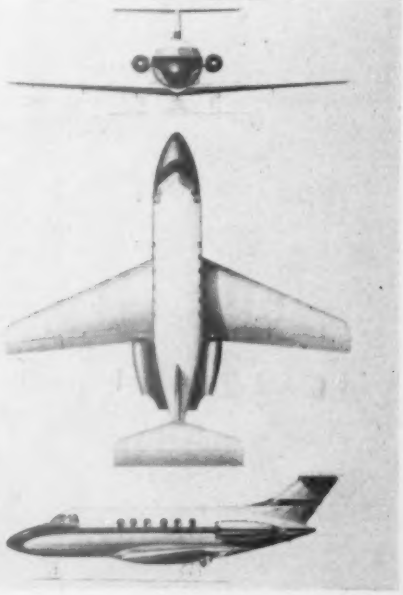
The wing will have a moderate sweep. Flying controls, rudder, elevators and ailerons, will be manually operated. Large double-slotted flaps and air brakes, for quick let-down, will be fitted. The clean wing will give low drag for cruise and the double-slotted flaps will provide high lift for take-off and landing.

Rear mounting of the engines allows the wing to be designed without the aerodynamic and structural compromises inevitable



This is the layout of the Jet Dragon cabin for carrying six passengers in executive comfort.

DH 125. EXECUTIVE SEATING ARRANGEMENT



with wing-mounted engines. The result is a clean, efficient wing which, for a given amount of lift, is smaller, lighter and has less drag than if the engines were mounted on it. This layout also gives a large unbroken area of flap which is particularly effective at the lower end of the speed scale and for landing and take-off. Placing the engines at the rear of the fuselage allows them to be close to the aircraft's centre line; this virtually eliminates asymmetric power problems when one engine is stopped. It also keeps the engine turbine discs well clear of the pressure cabin and of the fuel tanks in the wings as well as saving the structure from the effects of jet noise and buffeting. In addition, engine intakes are protected by the wing from the ingestion of stones thrown up from the runway.

The Bristol Siddeley Viper 20 engine adopted for the Jet Dragon is based on more than 10 years of development, production and operating experience. The first Viper ran in 1951 and the first production version powered the Jindivik target drone. Later versions powered advanced Jindiviks and the Hunting Jet Provost trainer. Latest production version is the ASV.11, which powers the Macchi MB.326 trainer for the Italian Air Force as well as the latest versions of the Jindivik and Jet Provost. It incorporates a redesigned compressor giving a substantially increased mass flow; its thrust is 2,500 lb.

The Viper 20 for the Jet Dragon will be rated at 3,000 lb. thrust for take-off. It is basically a Viper 11 with a zero stage added to the compressor. This raises the thrust compared with the Viper 11 and also reduces the fuel consumption from 1.07 to 0.985 lb./lb./hr. The improvement in performance is accompanied by a decrease in the already low working temperature of the engine, a factor which should ensure reliability and a long overhaul life. The conservative rating of the Viper 20 means that the engine has a considerable development potential.

Discussing operating costs, de Havilland state that "at first sight the cost of operation of the Jet Dragon appears high as compared with a piston-engined aircraft such as the Dove which carries approximately the same payload, but this is a fallacy for it ignores the all-important economic implication of speed. The executive aircraft differs not at all from any other tool of industry in that the faster it works the more it produces and if the cost per unit produced is no higher, so much the better.

"On the basis of aircraft miles flown the operating costs of the Jet Dragon will be almost exactly the same as those for the Dove; that is, on a realistic calculation, about two shillings and fivepence per statute mile. Assuming a representative utilization of 500 hr. per annum and an average stage distance of 500 st. miles, the Dove would fly about 71,500 miles in a year whereas the Jet Dragon would cover 166,500 miles in the same period.

"On the other hand if the travelling requirement was, say, 100,000 st. miles a year, the corresponding aircraft flying time (again based on an average stage of 500 miles) would be 700 hours for the Dove but only 300 hours for the Jet Dragon. Thus both the aircraft's flying time and the businessman's travelling time would be cut by more than half."

Technical Details

DIMENSIONS.—Length, 43 ft. 6 in.; wing span, 44 ft.; height, 14 ft.; wing area, 342 sq. ft.

WEIGHT.—Max. take-off, 18,000 lb.

POWERPLANT.—Two Bristol Siddeley Viper 20s of 3,000 lb. s.t. each for take-off.

PERFORMANCE.—Cruising speed, 450 to 500 m.p.h. Range, with reserves, approx. 1,500 miles.

Flight Simulation at Hamble

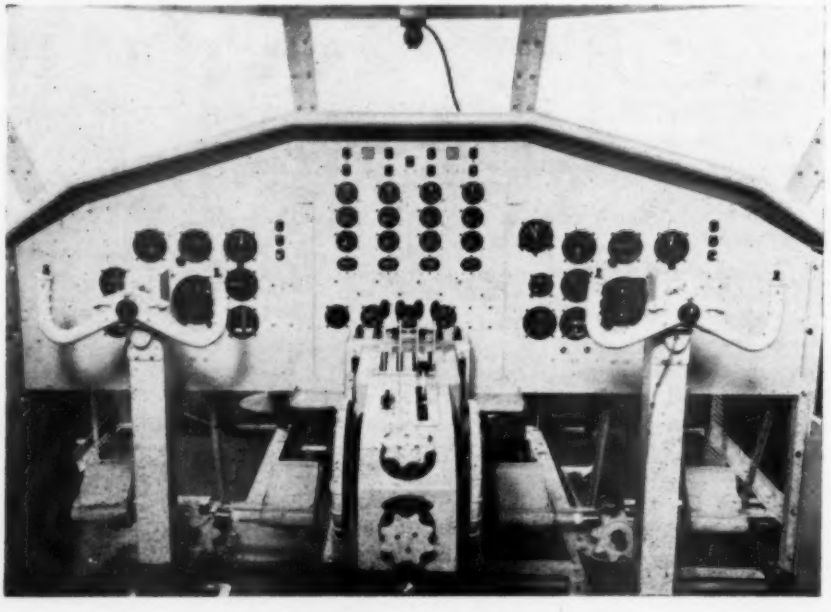
AS we briefly noted last week, the College of Air Training established at Hamble to train airline pilots has installed a flight procedure trainer built by General Precision Systems, Ltd. With this—and a second one to be installed later—it is intended to give students a grounding in the complexities encountered when flying multi-engined commercial transports in preparation for their airline flying. The College training fleet consists only of Chipmunks and Apache light twins.

The G.P.S. flight procedure trainer has been designed to represent in general appearance, layout and performance a typical modern multi-turbine aircraft. By adjustment of associated DC analogue computers and the use of pre-calculated plug-in units, the performance characteristics typical of aircraft of widely differing wing loadings and configurations with two or four turbojet or turboprop engines may be simulated.

Beginning with pre-flight cockpit checks and drill, it is possible for a student to be taken through a series of events from engine start and run-up, taxi-ing, take-off and climb to altitude, to a controlled descent to the point of touch down. Navigation exercises are provided for by a fully automatic radio-aid unit capable of simulating eight ground radio navigation beacons simultaneously and of recording flights of up to about 700 miles in range.

Throughout the simulated flight the student crew is able to practice the techniques involved in managing the various aircraft ancillaries such as electrical and hydraulic systems, as well as to compute fuel states, weights and other data necessary for the proper management of a large transport aircraft in flight. The simulator also makes it possible for a comprehensive selection of airframe, engine or system failures to be selected so as to give practice in emergency drill procedures.

The second G.P.S. procedure trainer is to be delivered to Hamble within the next few months. And with both these important pieces of equipment in operation, it will be possible for the College to widen the syllabus of its increasingly heavy training programme.



The flying controls and instrument layout in the new G.P.S. flight procedure trainers, one of which was recently delivered to the College of Air Training at Hamble; a second is due for delivery to Hamble within the next few months.

Spaceplane Propulsion

A spaceplane is an aircraft capable of entry into orbit, using for propulsion purposes the atmosphere through which it has passed. "Is it a practical proposition?"—asks

S. W. GREENWOOD, M.Eng., A.M.I.Mech.E., A.F.R.Ae.S.

WHAT rôle is the aeroplane to play in astronautics? Are the subjects distinct, or is there a link? These questions are, in effect, posed every week in the title of this journal.

An aeroplane is sustained in flight by the action of lifting surfaces that counteract the attraction of the Earth's gravity. When it is flying "straight and level" it is, strictly, doing nothing of the kind. The curvature of the Earth's surface results in the machine following a similarly curved path. At moderate speeds the effect of this is not important, but as speeds are increased so the influence of this becomes progressively more significant.

At orbital speed, motion in a circular path around the Earth is provided for by gravitational attraction, and no lifting surfaces are needed. The wings have, in effect, been unloaded.

Flight at speeds in excess of orbital speed within the atmosphere necessitates the use of "downward lift" surfaces if the machine is to stay within the atmosphere. Such requirements are familiar to those who have considered the problems of atmospheric entry from space at "super-orbital" speeds.

In the limit, an aeroplane is a vehicle capable of sustained

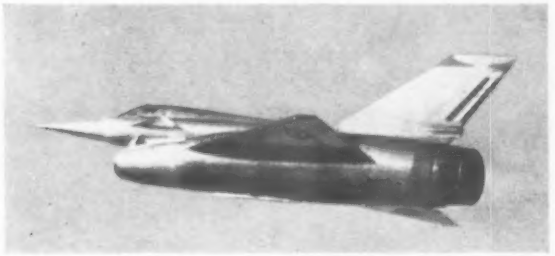


Fig. 1. The beginning—the Nord Griffon II.

flight within the atmosphere at speeds up to orbital speed. Such a craft is being contemplated seriously by several bodies in the United States at this time, and has been given the name of "spaceplane." Inevitably, the orbital operating conditions are only feasible at sufficiently high altitudes, and there is an obvious practical necessity for the capability of manœuvring in the atmosphere and in the orbital conditions at its fringe.

The interest being shown by military sources is discussed briefly in Ref. 1. The United States Air Force has requested an allocation of $20 million for research studies on spaceplanes in the 1962 fiscal year. A recent article (Ref. 2) in the magazine of the United States Air Force Association dwells at some length on the possibilities and problems. The United States Navy is also interested.

From the propulsion point of view it is obviously desirable

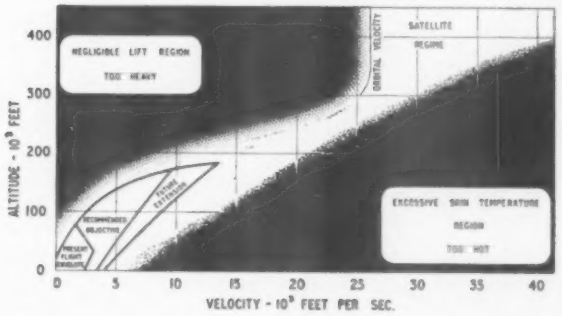


Fig. 2. Approximate possible regions for sustained flight—Bristol Siddeley Engines.

to make full use of the atmosphere through which the vehicle passes. The propulsion requirement is thus for air-breathing systems. Current American proposals involve the use of an advanced concept of propulsion technique in which atmospheric air is scooped-up during flight, and stored for subsequent use in conjunction with stored fuel on the rocket principle in the thin upper air during the last stages of flight into orbit.

The problems of scooping-up and storing air are considerable, and some of these will be considered later in this article.

The Ramjet

As speeds increase, the configuration of an aircraft becomes more and more intimately linked with the configuration of its propulsion system. For the greater part of the speed range contemplated, the only suitable powerplant in the opinion of the writer is the ramjet. Any practical spaceplane will therefore be ramjet powered during most of its flight.

At high speeds, the compression process, as is well known, arises from partially slowing down the inlet air, and the ramjet dispenses with the familiar turbine-driven compressor of the turbojet. The snag, of course, is that the engine cannot produce thrust from rest, and auxiliary power is needed to bring the system up to operating speed. Here, the turbojet is appropriate for manned machines, and the Nord Griffon II, shown in Fig. 1, is powered by a turbojet for low-speed flight and a ramjet for high-speed flight. Intended primarily for checking the characteristics of this so-called "combination engine," the machine serves as a practical example of the type of early work and thought that may lead to the spaceplane.

The Nord vehicle has been flown at speeds in excess of Mach 2. To put things into perspective, however, it is necessary to appreciate that orbital speed, 5 miles/sec. in round figures, is about Mach 25. Supersonic military aircraft and ramjet powered missiles are undoubtedly pressing upward in the speed

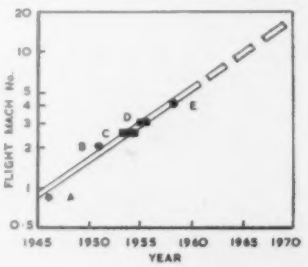


Fig. 3. Ramjet propulsion speed trends, from Ref. 4.
A. Marquardt subsonic engine.
B. Rigel.
C. Bomarc ramjet.
D. Navajo ramjet.
E. Marquardt supersonic engine.

range, but there remains a large gap in experience before completely controlled flight into orbit becomes possible.

The practical flight regime—the flight corridor—is shown in Fig. 2. Entry into orbit involves flight up the corridor, altitude increasing with increasing speed. Orbital conditions are reached at heights of 60 miles or more. The thoughts of one organization, the experienced ramjet team at Bristol Siddeley Engines, in April, 1959, were given in a paper to the Colston Research Society, from which Fig. 2 is derived. Their ambitions at present appear to be directed to practical objectives that lead towards, but lie short of, the full into-orbit concept. It is significant that the zone marked "present flight envelope" is now wider than shown, and the same will surely apply to the other zones.

The lower boundary of the flight corridor is formed by the practical acceptable upper limits of skin temperature due to kinetic heating. In the sense that the spaceplane may be expected to follow a substantially unpowered path during its return flight, and duplicates approximately the altitude-speed variation of an atmospheric entry vehicle in reverse during its ascent into orbit, the skin temperatures anticipated for the spaceplane will be comparable with those of the atmospheric entry vehicles on which experience is shortly to be gained.

In this respect it may, therefore, be argued that, by the time the project has approached the hardware stage, most of the materials and structural problems will appear manageable.

The difference between conventional aircraft and the space-

plane concept is that the objective with the conventional machine, broadly speaking, is to accomplish flight at a given speed over a desired range. The spaceplane, on the other hand, is called upon to accelerate continuously up to a desired speed, and the range covered in the process is largely incidental. Once in orbit, the range is practically infinite.

Some Performance Considerations

The obvious promise of the spaceplane as compared with the conventional rocket vehicle is that the former makes use of the atmosphere for propulsion purposes and so requires less carried propellent. The broad outline of the comparison of ramjet and rocket powerplants for astronautical purposes has been discussed by the author in Ref. 3, and only the main conclusions will be repeated here.

Ramjets will produce a given thrust for a lower rate of consumption of carried propellent than the rocket, but the

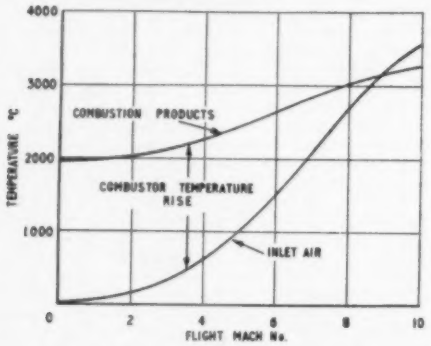


Fig. 4. Effects of flight speed on combustion system, from Ref. 5. Fuel—kerosene.

powerplant mass will be higher. To be competitive with the rocket, the ramjet must, therefore, operate for a sufficiently long duration. In the spaceplane application this implies the need for efficient operation over a wide speed range.

It is impossible to acquire accurate estimates of the practical speed range of current high-speed ramjets owing to the security position, but Mach 2-5 would probably be reasonably typical. As shown in Ref. 3, this is too small to be worth while in astronautical applications involving entry into orbit. Considerable increases in this variation are called for.

Taking, arbitrarily, a steady acceleration from rest to orbital speed of 2/3 gravitational acceleration, we find that it would take just over 20 minutes to go into orbit, and that a distance of just over 3,000 miles would have been travelled in the process.

Some idea of the thrust requirements during flight may be gathered from the following relationship:—

$$\frac{\text{Thrust}}{\text{Weight}} = \frac{1-(\text{C.F./Weight})}{(\text{Lift/Drag})} + \frac{\text{Accn.}}{\text{Grav. Accn.}}$$

From this, the total engine thrust as a fraction of total vehicle weight at any time may be related to the centripetal force (C.F.) associated with the path around the Earth and the forward acceleration.

This relationship involves slight approximations, but is sufficiently accurate for our purpose. The selection of a suitable acceleration is an involved aerodynamic and structural exercise, and discussion of this point would be unprofitable at this stage. The centripetal force increases in proportion to the square of the flight speed, and the wing "unloading" therefore becomes appreciable as orbital conditions are approached.

It is tempting to suppose that this will lead to a useful reduction in the thrust requirement, but the equation is a warning to us to consider the behaviour of the wing as a producer of lift and drag also. The sad reality, so familiar to designers of supersonic aircraft, is that lifting surfaces have poor qualities at high speeds, and the indication is that the lift/drag ratio becomes progressively worse as speeds are increased. As shown in the equation, this effect offsets the benefits of increasing centripetal force. There will probably be some periods in the flight when one side of the divisor will win, and some periods when the other will be the victor.

To get a very preliminary "feel" for the problem, it is possible that the thrust may be no more than halved in the course of the flight into orbit, though in the very last stages, of course, the thrust requirement is for accelerating purposes

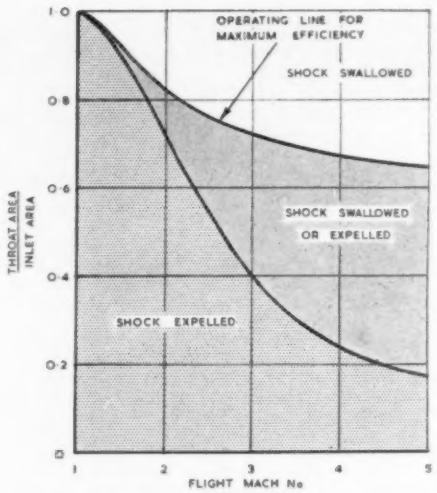


Fig. 5. Effects of flight speed on internal compression inlet. (The lower curve makes an arbitrary allowance for boundary layer growth.)

only, and ultimately has a minimum value for overcoming the small drag at high altitudes.

Engine Problems

The main powerplant must be a ramjet. Operating speeds have been steadily increasing for this type of engine, as indicated in Fig 3. Extrapolation of experience to date suggests that near-orbital speeds will be feasible around 1970. The picture presented in the figure must be interpreted with caution —it may be either too optimistic or too pessimistic.

Conventional ramjet experience is a useful guide up to about Mach 5. This is the boundary of the supersonic and hypersonic flight regimes, above which we meet many new and largely unfamiliar problems.

A determining factor in hypersonic ramjet design is the severe level of temperature encountered in the combustion zone (Fig. 4). At Mach 7, the temperature of the inlet air rises above 2,000° C. In conventional designs this would lead to a number of difficulties owing to the impossibility of cooling the engine walls adequately by radiating away some of the heat transferred from the air. The problem in the combustion zone would clearly be even more severe than in the inlet.

Owing to the high amount of dissociation experienced at these temperatures the temperature rise across the combustion zone progressively decreases as the speed increases, and may even be negative at the higher Mach numbers. Dissociation represents a loss of available heat release, and although some recombination may occur in the exhaust system as pressure falls, it is not yet certain how much of the thrust loss may be recouped in this way.

These and other combustion problems are discussed in Ref. 5, and the advantages of combustion at supersonic gas speeds have been looked at in some detail by the, then, NACA in an attempt to get round the difficulties. If the inlet air is only partially compressed to a convenient supersonic speed, the static temperature of the gas is kept at lower levels, and the pressure is also lower. This should reduce the heat transfer problem and also reduce dissociation.

Mordell discusses the advantages of this technique in his comments on Ref. 6. He speculates that the apparent disadvantage of the high gas speed from the viewpoint of stabilizing a

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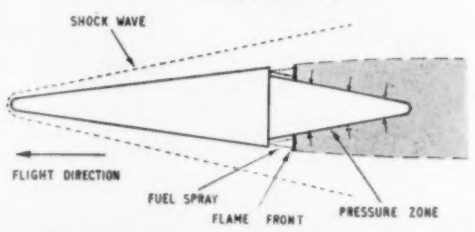

Fig. 6. Hypersonic ramjet. Two dimensional: double wedge. Three dimensional: double cone.

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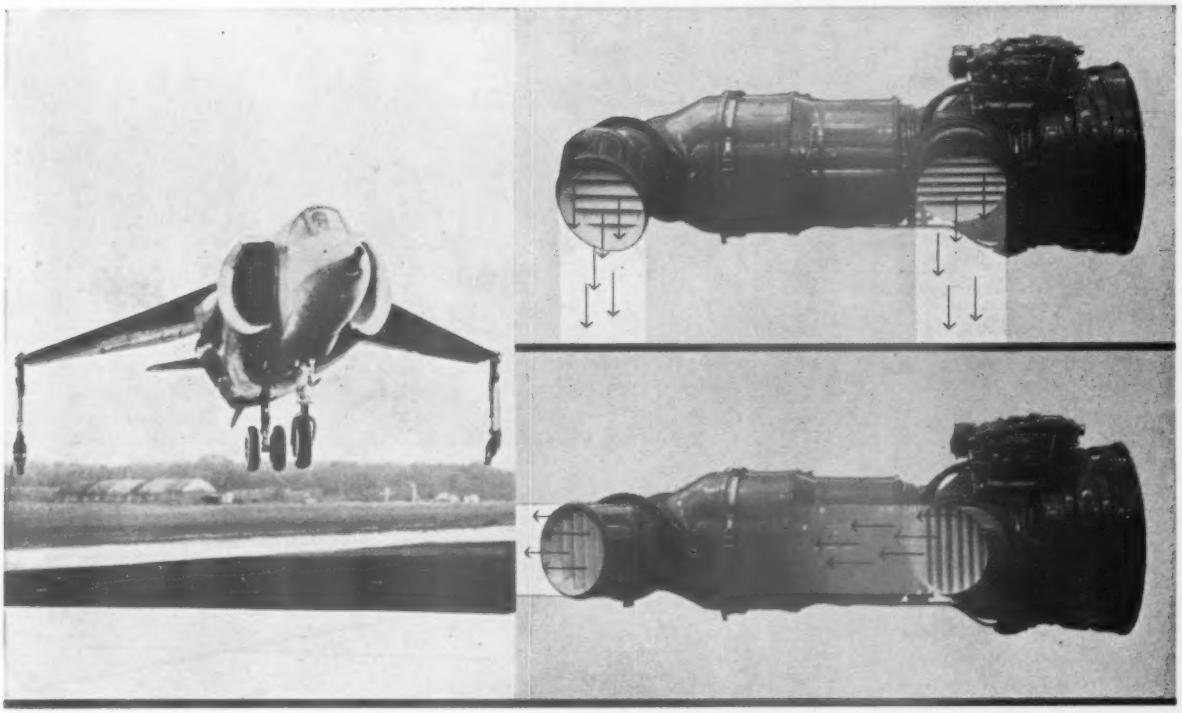
LIFT and THRUST from ONE ENGINE– the revolutionary Pegasus turbofan



The new Bristol Siddeley Pegasus high-ratio turbofan represents a major engineering breakthrough in the field of aircraft propulsion.

Because the Pegasus can be fitted with movable nozzles evenly disposed around the centre of gravity which give directional control to its total thrust, this remarkably versatile engine provides the airframe designer with *a single power source for all conditions of flight.*

VTOL, STOL and normal take-off capability in the same aircraft. Suitable for subsonic or supersonic applications.

High by-pass ratio gives high thrust for low weight, low fuel consumption and low noise level.

Conventional installation. Operational simplicity. Independent of all fixed ground installations.

Problems of ground erosion, recirculation and ingestion of debris reduced to a minimum.

The Bristol Siddeley Pegasus has already been selected for, and is now undergoing trials in the Hawker P 1127 VTOL light strike aircraft and is supported by the Mutual Weapons Development Programme for NATO.

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MARCONI DOPPLER

IN THE ARGOSY C Mk.1

The *Armstrong Whitworth Argosy C Mk. 1 for the Royal Air Force Transport Command will be fitted with Marconi AD2300B Doppler Navigator and Track Guide Computer.

** They will also be fitted with the Marconi AD712 Automatic Direction Finder.*

MARCONI

AIRPORT AND AIRCRAFT RADIO SYSTEMS

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(*Continued from page 598*)

flame is likely to be adequately offset by the increased reaction rates obtaining at these high temperature levels.

The problem of pumping and controlling the fuel to the engine may well prove serious, particularly where rotating parts are used at high operating temperatures.

The engine configuration will also be affected by the characteristics of the compression techniques employed in the inlet. The "ideal" inlet aerodynamically is the isentropic internal compression type that looks like a convergent-divergent nozzle in reverse (see Fig. 8). Such a design has a low external drag, and can be made almost perfectly efficient by careful control of the inlet flow. It has characteristics that are summarized over the low supersonic region in Fig. 5.

Unfortunately, the line of best operating efficiency is on the boundary of a region in which a small disturbance can bring about expulsion of a strong shock wave ahead of the inlet and cause a violent interruption of the internal flow. At the higher Mach numbers contemplated for the spaceplane such a disturbance would probably be disastrous. It is preferable, therefore, to abandon ideas of using conventional internal type inlets, and obtain compression externally.

It is not practicable to use the common central spike design of external compression inlets owing to the impossibility of combining efficient compression with moderate external drag at high speeds. The external cowl is, therefore, best omitted.

This brings us round again to the combustor, where it is obviously preferable to provide for radiation of heat from combustion zone boundaries to keep the walls of the combustor as cool as practicable. We then arrive at a new concept of the hypersonic ramjet, developed in theory in some detail in the United States in recent years, and illustrated by the author's interpretation in Fig 6.

Fuel is injected into the compressed, but still supersonic,

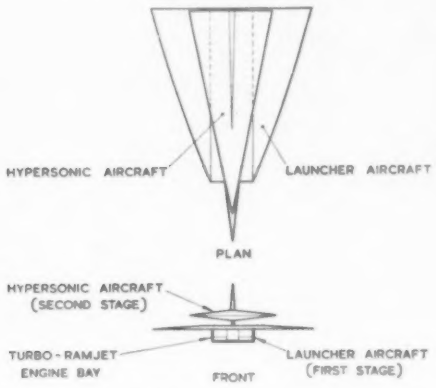

Fig. 7. Diagrammatic layout of two-stage hypersonic aircraft (Bristol Siddeley Engines). First stage—Mach 4. Second stage—Mach 7.

region of flow behind the bow shock wave. Combustion takes place in the supersonic flow region over the afterbody. In the absence of burning the pressure over the rear portion of the engine would be less than that over the forward portion, and the body would experience a drag.

Burning modifies the flow so that the pressure exerted by the gases flowing over the afterbody is higher than that over the forward part, and the engine then produces a thrust. An orange pip can be propelled by the pressure of thumb and finger in similar fashion.

The critical problem of the temperatures encountered at skin surfaces at high speeds is rendered as manageable as possible. Conditions over the forward portion of the engine may be broadly compared with those experienced by the forward portions of other parts of the vehicle, and are thus acceptable within the limits of the flight corridor. Over the rear portion of the engine, higher temperatures will be realized, and this may set the limit on the closeness with which the lower boundary of the flight corridor may be approached.

The entire surface of the engine radiates heat away, and this will be helpful in reducing surface temperatures. Additionally, great skill will undoubtedly be called for in design and development to make the best use of opportunities for controlling fuel injection and air flow patterns in order to obtain a satisfactory compromise between efficient heat release in the combustion zone and the lowest possible transfer of heat from that zone to the rear portion of the engine.

Any suggested design is open to criticism on a vast number

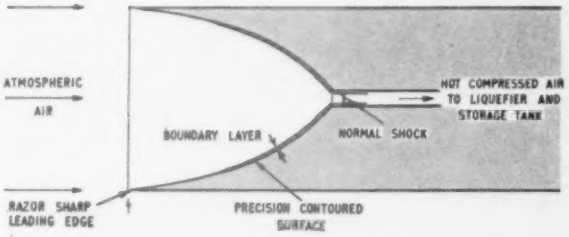

Fig. 8 Hypersonic airscoop for air storage system.

of grounds. The uncertainties involved in the flow pattern over a range of speeds with a range of fuel flows are considerable. The need for extensive experimental investigation over a representative range of operating conditions is obvious. A design that started off on paper looking like Fig. 6 would be practically certain to look nothing like it after a few years' detailed study.

A possible layout for a hypersonic vehicle using wing-type ramjets for a combined lift-thrust action is indicated in Fig. 7. In this paper study the vehicle is boosted to Mach 4 and then accelerates to Mach 7, for sustained flight over a long range at that speed. While the gap from Mach 7 to Mach 25 is large, it is consoling to recognize that shock wave patterns have the happy characteristic of settling down at the higher speeds, and the problem of bridging the gap may not be as severe as at first appears.

The capacity to manœuvre adequately in the thin upper atmosphere has suggested the possibility of storing air or oxygen during the flight into orbit, in order to use it with stored fuel in orbit on the rocket principle. Such schemes form a significant part of the current United States Air Force studies, and are briefly reviewed in Ref. 7.

The principle of air-scooping and storage is illustrated in simplified form in Fig. 8. Atmospheric air is entrained, compressed in an intake, then cooled and further compressed and stored in liquid state in a tank.

It will be admitted that handling compressed air at a temperature of several thousands of degrees Centrigrade prezents obvious and considerable difficulties. Here, however, attention will be confined to the inevitable problems to be faced at the outset in entraining and initially compressing atmospheric air in the intake.

The central spike type intake has already been judged unsuitable for high Mach number flight because of the large external drag associated with such an intake. Any scoop employed for an air storage scheme must be of the type shown in Fig. 8. Its limitations will be those already considered in conjunction with the discussion above on intakes for hypersonic ramjets, and such designs may have to be rejected for the same reasons.

The razor-sharp leading-edge is liable to damage, apart from being difficult to provide in the first place. The internal flow pattern and boundary layer growth is sensitive to small changes in the internal surface contour, and thus to damage by meteorite impact or other causes. Disturbances in the flow system downstream of the intake, or disturbances resulting from the types of damage quoted, might result in expulsion of the normal shock wave that normally lies downstream of the intake. This could disrupt the whole flow pattern through the engine, and in general would be disastrous.

Provision for avoiding this danger involves the employment of a complex control system, including variable outlet area for the intake to permit safe and efficient operation over a range of Mach numbers.

The problems facing the hypersonic scoop designer are quite terrifying. Rewards of achievement in this field, and in those of high temperature refrigeration are, nevertheless, high. Research is clearly desirable, and American developments in this field will be watched with interest.

In this article so much emphasis has been placed on the technological uncertainties in the way of the realization of the spaceplane that it is clear that this question cannot yet be answered one way or the other. The propulsion problems alone, on which so much else depends, call for extensive study. The practical spaceplane will, in any event, almost certainly turn out in the long run to be a boosted ramjet vehicle.

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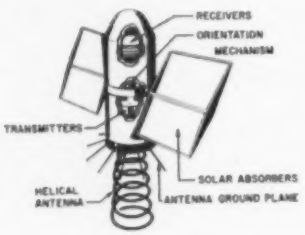
Discussing Satellite Communications—2

Continuing our report of the B.I.S. Symposium on Communication Satellites held in London on May 12

ALTHOUGH the synchronous satellite at 22,300 miles altitude is far from ideal for relaying telephone conversations, it does provide an excellent platform for the rediffusion of television. Mr. G. K. C. Pardoe (de Havilland Aircraft) reminded the meeting that it was Mr. A. C. Clarke, a former chairman of the British Interplanetary Society, who first advanced the idea of using artificial satellites for this purpose; that was 16 years ago.

Clarke's original proposal, published in *Wireless World*, had been that three satellites equally spaced in a stationary orbit above the equator would serve to broadcast television programmes to the entire World. This theme was taken up at the B.I.S. Symposium by Mr. R. P. Haviland (General Electric Co.) who proposed that each satellite should embody several transmitters. One or two of these would be used to provide blanket coverage for the whole surface of the Earth visible from the satellite, while one or more others would be used to provide a service of high quality in areas of high population density, such as the United States and Western Europe.

Transmitters of 50 kW. necessary for this service do not come in miniaturized form, said Mr. Haviland; nor is the power demand negligible. This means that the television service cannot be established with small rockets. He estimated that the 50-kW. transmitter might weigh 10,000 lb., with a total primary power demand of 400 kW. including an allowance for various audio transmitters. He thought that a single 50-kW. transmitter could be installed in a satellite in about seven years. A multiple transmitter system might then be expected in the 1970-75 period.



A small satellite for FM broadcasting of voice and music (R.P. Haviland).

Consideration of the distribution of land and population indicates, the speaker continued, that the three satellites should not be equally spaced. Superior coverage can be obtained if they are located at 100°W., 30°E. and 120°E.

It is also desirable that the satellites are of standard design, each incorporating two general-coverage channels and six limited-area channels. The antennae for these would be stabilized with respect to the Earth. Mr. Haviland considered that vehicles of this size (the main parabolic antenna might be 200 ft. x 300 ft.) "would undoubtedly have to be manned to secure low-cost, long-term operation."

In view of the difficulties surrounding the provision of a full TV service, it was considered that "space broadcasting" might start with a simpler service, possibly the high-quality FM broadcasting of voice and music. Calculation indicated that a service of this kind could be provided with approximately 1,500 W. of power in the satellite.

Reliability Factors

Clearly, before commercial operations on this scale become practicable, many detail problems will have to be solved affecting the satellites' reliability and operating life. Dr. J. R. Pierce (Bell Telephone Laboratories) considered this aspect in some detail.

Most active space payloads, he said, depend on solar cells, together with storage batteries, for supplying electrical power. Sunlight has an energy of about 130 W./sq. ft., and solar cells can turn about 10% of this into electrical power initially. Although cosmic rays have little effect on solar cells, certain space radiation will tend to degrade them. Less than a tenth of an inch of glass, quartz or sapphire, will shield solar cells adequately from the electrons of the outer Van Allen belt, which is most intense some 13,000 miles above the Earth's surface.

However, it appears impossible to protect solar cells against the effects of the protons of the inner Van Allen belt, which is most intense at an altitude of about 2,000 miles and which extends to perhaps 5,000 miles. The extent, intensity, and composition of the radiation have yet to be carefully measured, and their changes with time accurately determined.

We are uncertain by, perhaps, a factor of 12, said Dr. Pierce, as to when the efficiency of a solar cell will have fallen to some preset design limit—say 5%. Our best present estimate is that the solar cells in a satellite a few thousand miles high would last for several months to several years. Solar cells on higher satellites would last longer.

While all solid-state electronic devices are subject to the hazards of radiation, transistors and diodes are in general less sensitive to radiation than are solar cells. Moreover, they are better protected, both by metal encapsulations and by their location within a metal-clad satellite structure. However, this does not mean that satellite electronic equipment does not face special problems and hazards in a space environment.

In our experience so far, the operation of apparatus on command from the ground has been particularly hazardous. One would expect apparatus to function most reliably when it runs continuously without interruption, and experience indicates that this is indeed the case.

What is the situation concerning orientation and station-keeping? Atlas nose-cones have been successfully orientated for tens of minutes. Discoverer satellites have been orientated for days. If communication satellites are to be commercially useful in competition with cables, they must last for years.

Will gas valves operate for years without leaking? Will bearings work for the same period in vacuum without freezing? What is the chance that during its years of operation some brief fault in the orientation system will set the satellite spinning?

Just how dependable will orientation and station-keeping equipment be? If such equipment depends on commands from Earth, could we really count on its responding to our commands and on its not responding to signals of other origin? We shall only really know after we have acquired some experimental experience.

Through the favourable outcome of the Echo experiment, Dr. Pierce concluded, the capabilities of a passive satellite have been established. Granting an equally favourable outcome following the experimental launching of a simple active satellite, a practical communication system making use of many low-altitude satellites in random orbit need not be many years distant. This is what the Bell Laboratories are working toward.

Blue Streak Capability

Mr. Pardoe's paper reviewed the various factors that influence the engineering and economics of satellite systems. He considered it logical for a global telephone system to involve a pattern of satellites at medium altitudes (say between 4,000 and 10,000 miles), each one being maintained on its correct station and not allowed a random position.

To establish such satellites in these conditions requires, with current techniques, a multi-stage launching vehicle with a lift-off thrust of at least 200,000 to 300,000 lb. Mr. Pardoe said that as the lift-off thrust of Blue Streak can be in the order of 300,000 lb., it is clear that this rocket satisfies our requirements, whereas smaller rockets such as Scout and Thor certainly would not.

Another paper of interest dealt with the problem of "channel dropping"—a system whereby a satellite can provide communication between a number of pairs of ground stations. This subject was ably handled by Mr. E. K. Sandeman (English Electric Aviation) who described a technique of his own for eliminating echo at the far end of four wire land-lines associated with satellite radio links. A supplementary paper by Mr. J. Bradley (English Electric Aviation) dealt with "A PCM (pulse code modulation) coding and decoding system."

Courier, the delayed-action repeater satellite, was the subject of a paper by Messrs. G. F. Senn and P. W. Siglin (U.S. Army Signal Research and Development Laboratory), and Mr. E. A. Laport (Radio Corporation of America) dealt with the problems involved in establishing an "International Satellite Communication System."

All these papers, clearly of considerable significance to the fast-growing satellite telecommunication interests in this country, are to be published in a special issue of the *Journal* of the British Interplanetary Society.

Flying the Piper Pawnee

By John Fricker

AFTER flying a long succession of sleek, shiny and superlative American light aeroplanes, it was a salutary experience to get into the agricultural Piper Pawnee at Baginton during the recent Shackleton sales week-end. This unhandsome utility aircraft comes from the same line of best-selling personal and executive types marketed throughout the World by the Piper Corporation, but in its own highly specialized field it is as successful as its more glamorous stablemates.

Over 700 Pawnees have left the Lock Haven production line since the project was transferred in 1959 from Piper's Development Center at Vero Beach, Fla. There, it was developed under the direction of Fred Weick, the well-known light aircraft engineer, as virtually a projection of the Ag-3 agricultural aircraft which he was responsible for designing at the Texas A. and M. College.

At the same time, the Pawnee was required to be based on the veteran Super Cub, which in its utility form is unquestionably the most widely used agricultural aircraft ever built. The number of PA-18As in use runs into thousands, and this vast accumulation of spraying and dusting experience provided the main background for the development of the Pawnee as the "ideal" agricultural aeroplane.

For the minimum cost, and to reduce spares complications for PA-18A operators, the main airframe components of the Super Cub were adapted for use in the PA-25 Pawnee, which is also powered by a similar Lycoming O-320 engine developing 150 b.h.p. at 2,700 r.p.m. The metal-framed Cub wings were moved from the high- to the low-mounted position, retaining the Vee-strut bracing to the steel-tube fuselage. This change was made to take advantage of the improved visibility, particularly in turns, of low-wing aircraft, and their improved flow distribution for chemical dispensation.

Compared with the Super Cub, the tandem positions of the pilot and chemical hopper were reversed in the Pawnee, to place the load squarely on the C.G., thereby avoiding trim changes. With the pilot aft of hopper, fuel tank and engine, the maximum crash protection is obtained and the possibility of being "sandwiched" between heavy masses is eliminated.

Photographs copyright "The Aeroplane and Astronautics"

The vast cockpit of the Pawnee has a strictly functional air with its lack of soundproofing and simple appointments, but it is designed for both comfort and crashworthiness.

Placing the pilot high on the fuselage gives the optimum all-round view, and allows the cockpit floor to be raised 10 in. above the bottom longerons to provide extra energy absorption in case of relatively flat ground impact.

The ultra-low altitude and heavy load operations of agricultural aircraft in confined spaces are not good insurance prospects, but the Pawnee has been designed on the recommendations of the Crash Injury Research Unit of Cornell Medical College to give its pilot the best chance of walking away from a major accident. The fuselage, with its quickly removable metal front panels for servicing access and fabric-covered rear section, was designed to collapse progressively in a crash to reduce deceleration of the cockpit. Except under the most severe conditions, the cockpit area will remain intact, and its tubing is bowed to avoid deformation into the cabin.

This attention to safety extends to such details as a steel-tube turn-over structure above the pilot, with a glass-fibre covering to prevent it sinking into soft mud when overturned. From the top of the cabin to the fabric-covered fin extends a stout cable to deflect any wires that may be encountered, and the leading-edges of the sturdy Tri-Pacer type mainwheel legs, with their bungee and hydraulic springing, are sharpened to shear through wires or small branches.

Oversize Comanche-type hydraulic disc brakes are fitted to Apache-size wheels and tyres, and legacies from other Piper aircraft include the swinging engine mount of the Cubs, for easy access to the rear-mounted Lycoming accessories, and a comfortable sliding Apache-type seat to minimize fatigue during prolonged agricultural operations. Access to the Pawnee is gained through either of the large downward-folding side panels of the cockpit.

Once perched on the lofty pilot's seat, one gets the impression of being in a cockpit built for giants, so far is everything away. This, of course, is deliberate, to keep the pilot as far as possible from harm, but the essentials, such as stick, throttle quadrant and rudder pedals, are convenient to hand and foot. Essentials are all you have in the Pawnee; anything else would soon be discarded by load-hungry operators. There is no soundproofing in the cockpit, which has a curiously naked look, except for a profusion of levers and pipe runs.

Most of these are concerned with the agricultural equipment, although a left-hand lever controls the three-position small-area flaps. The exposed feeling one gets in the Pawnee, I discovered, is through being able to see one's feet on the rudder pedals not far in front. Normally, one's legs disappear decently beneath the instrument panel in most aircraft, but in the Pawnee the strip of knobs and gauges—too elemental to be called a panel—is located far forward out of reach of one's head in a prang, and in fact lines up with the rear of the chemical hopper which forms the front bulk-head of the cockpit.

Small recesses in the glass-fibre hopper accommodate one's feet as they move forward on the smooth safety-type rudder pedals. The hopper is translucent so that the load can actually be seen, and checked against graduations on its rear surface.

Hopper capacity is 150 U.S. gal. (125 Imp. gal.), 20 cu. ft. or 800 lb., depending how you like to measure it, so that on its 150 b.h.p. the Pawnee is licensed to carry the equivalent of 5-6 people in addition to 33 Imp. gal. of fuel. It is, of course, only a single-seater, although a jump seat may be fitted in the hopper if required to transport a mechanic or loader in some discomfort between operations.

The fuel tank is forward of the hopper; it is also of glass-fibre, and its top similarly forms the upper profile of the fuselage. It employs foolproof and lightweight gravity feed, and has a direct-reading quadrant-type gauge on its top. So far forward is it from the pilot, that you feel binoculars would be of some assistance; but in fact it proved quite simple to read. The nose of the Pawnee drops steeply away like some of the

The Pawnee is about as elegant as a tractor, and correspondingly useful to the farming community. The 46-nozzle high-density spray-bars can spread liquids up to 12½ Imp. gal. an acre.

better deck-landing aircraft of World War II, but even with a thick cushion on the upholstered seat, I was unable to see any part of it except the fuel gauge, over the light-alloy scroll surmounting the instrument strip in the gigantic cockpit.

The scroll is there to bash one's bone-domed head safely against should the shoulder-harness prove inadequate restraint in a *bumslandung*, as the Germans expressively put it. An inertial reel on the harness proved invaluable, as an optional extra, in reaching the unprotected starter button on the right of the panel, after turning on the fuel and the master switch. In the remote distance ahead of the cockpit I was gratified to see an apparently tiny toothpick propeller turn over.

The Lycoming fired immediately with a smooth and offstage purr, and a stab of toe brake released the looped wire parking catches on each side of the cockpit. I was then free to pick my way through the congested aircraft park at Baginton, looking down from my lordly perch at the crowds of number-taking small boys who ignored whirling propellers a few inches from their heads for the thrill of recording yet another registration in their notebooks.

I found the all-round view from the Pawnee absolutely magnificent except directly forward, for which I blame my medium height. Manœuvrability with the steerable king-sized (8 inch) tailwheel was excellent, without recourse to powerful toe brakes, which did not seem likely to raise the tail when used vigorously.

With only very basic flight and engine instruments, pre-flight checks were confined to confirming neutral setting of the adjustable tailplane, actuated as in the Cubs, by a crank handle on the port cockpit wall. I found later, however, that the trim crank is not low-geared like the Cub or Tri-Pacer, and a small movement accomplishes a large variation in bias.

Throttle knob of the Pawnee was a little too close to the cockpit wall for comfort, but on opening up to full power with the stick central, G-APVY floated skywards at 45-50 m.p.h. after running a few yards with virtually no attention from me. There seemed little or no swing, although a touch of right rudder was subconsciously applied, and with an empty hopper the Pawnee felt very buoyant. At 70 m.p.h., the rate of climb did not feel sensational, but I got the impression that it would not vary all that much with a full load.

With no helmet, bone dome or sound-proofing, the noise level in flight was naturally fairly high, and included the odd rattle that one would associate with a piece of farm equipment. There was some evidence of rudder buffet during the full throttle climb, probably from the flow round the tall cockpit "pylon." I had the folding side windows closed, although these can be left open in more temperate climes than Coventry's.

My first job on getting airborne in the Pawnee was to formate on a Super Cub carrying our photographer, and this exercise, although far removed from the agricultural rôle, always gives one a good indication of general handling qualities. Despite its quaint outline, the Pawnee proved light and responsive for this sort of flying, with well co-ordinated controls.

Slight lateral pressure was sufficient for small aileron deflections, although there was some heavying up at larger angles. A healthy rate of roll was there if one wanted it, however, and the Pawnee seemed unlikely to prove fatiguing in the gruelling business of hauling a heavily loaded aircraft round in tight turns close to the ground for up to 10 hours a day, that is crop-spraying.

With spray bars installed, plus a ventral windmill pump (braked when not in use by a cockpit control), and unfaired undercarriage legs, the Pawnee indicated about 90 m.p.h. at around 2,500 r.p.m., which is very reasonable for between-jobs cruise. Moving in on the photographic Cub through the Midland murk called for rather more rudder operation than one would normally use for any other type of flying, but directional control was excellent if heavier in its accepted place after ailerons and elevator.

A pleasing feature of the Pawnee was the noticeable decrease in trim changes compared with the PA-18A Super Cub which I had flown in agricultural form several years ago. A fractional movement of the trim crank took care of the slight changes with varying power and flap settings, which is a further anti-fatigue factor. In the latter connection, although lacking some creature comforts, the Pawnee has the usual efficient American heating and ventilating systems.

A brisk peel-off disposed of the photographic flying, leaving me free to explore general handling. Starting at the bottom end of the speed scale, I pulled out the carburetter heat knob on the throttle quadrant, and reduced power to idling, holding the slight nose-down pitch with a few inches of aft stick. Decrease in speed was naturally fairly rapid, until at about 50 m.p.h. I.A.S., the massive red light on the left of the panel started winking out its stall warning. The Pawnee nodded in and out of buffet and breakaway at 40-45 m.p.h. I.A.S., with the stick held back, but some lateral control was still available.

Lowering the tiny flaps of the Pawnee to the second (full) extended position, and applying a trickle of power while raising the nose brought the stall-warning "beacon" on again at 50, but the speed could be reduced right off the clock to less than 40 m.p.h. I.A.S. before buffet and a straight breakaway resulted. A good-tempered aeroplane is essential for crop-spraying or dusting, and there can be no complaints on that score against the Pawnee.

It has one unusual characteristic, however, that has caused some controversy, and delayed the validation of its American C. of A. in the U.K., although it is now cleared here to full aerial work standards. In a sideslip, the airflow around the canopy appears to cause rather a pronounced tailplane buffet, although no dire results ensue. I found that the hard judder was apparent at fairly small rudder deflections, and looking over one's shoulder, the wire-braced tailplane could be seen oscillating cheerfully and innocuously.

Pawnee operators all over the World have apparently found this characteristic of little significance, and since the aircraft is flapped, sideslips can simply be avoided. I noticed on the approach that with full flap and power off, maintaining about 60 m.p.h. felt as if one was in a Stuka, because of the nose fall-away, but a glance out towards the wing-tips showed the true attitude to be quite moderate.

Because of the unsually high seating position, I found myself tending to flatten out earlier than I should have done, but the Pawnee proved simple to feel on to the ground, for a short and smooth landing on the Hydra-sorb gear. A second circuit confirmed the landing tractability, and a low-altitude overshoot gave some idea of the agricultural "feel."

The Pawnee retains all the good handling qualities of the Cub, and adds some more of its own. Its U.K. delivered price, including 17½% duty, of just over £5,000 is unrivalled by any comparable utility aircraft and, in the U.S., Piper claim that it costs approximately $11 per pound of chemical load carried, compared with from $20 to $40 for other agricultural fixed- and rotating-wing types.

Leading Particulars

DIMENSIONS.—Span, 36 ft. 2½ in.; length, 24 ft.; height, 6 ft. 9½ in.; wing area, 183 sq. ft.

WEIGHTS.—Empty, 1,200 lb.; useful load, 1,100 lb.; max. gross, 2,300 lb.

PERFORMANCE.—Max. speed, 100 m.p.h.; cruising speed, 90 m.p.h.; stalling speed, 57 m.p.h.; initial climb, 510 ft./min.; service ceiling, 11,300 ft.; take-off run to 50 ft., 1,375 ft.; landing run from 50 ft., 930 ft.; endurance, 4½ hr.; range at 75% power, 400 miles.

Gliding Notes

by Dr. A. E. Slater

TWELVE years ago the Portsmouth Naval Gliding Club started up at Gosport with an open EoN Primary, a Kirby Cadet and a Grunau Baby. When I visited the club on Apr. 30 at Lee-on-Solent, to which it moved after Gosport closed down, it still had a Grunau and Cadet, but the Primary had long since vanished and been replaced by a T-21. The club also possesses a Skylark 2, while Lieut. Cdr. Humphry Dimock, who kept his Eagle there, is selling it and now has a Skylark 3.

Another machine in the hangar is the old Rhönsperber, owned in pre-War days by Kit Nicholson, Jack Dewsbery and Philip Cooper. It was left exposed to the elements during the War and needs a lot of renovation. Somebody has started rebuilding the nose and made a new main spar, but no more work is being done on it at present.

There are three naval gliding clubs in action, the other two being in Scotland, at Arbroath and Lossiemouth. At Lee-on-Solent the membership is 63, about the same as it was in 1949. Apart from an Austin Gypsy for retrieving, largely paid for by the Nuffield Trust, the club is unsubsidized, so rising costs will soon push the full annual subscription up to £3, and £2 for junior members, and the launch fee to 3s. But these figures are still low compared with civilian gliding club standards.

Being on the shore of the Solent, the club gets good thermals only in northerly and easterly winds. During 1960, however, in spite of generally poor weather, 180½ hours' flying was done and soaring was possible on 14 of the 91 flying days, including an afternoon in January when a stationary belt of lift developed along the coast. As described in these Notes at the time, it could only be explained by a S.W. wind coming up one branch of the Solent impinging on a S.E. wind from the other branch.

The club has the advantage of a magnificent view from the top of a winch launch, embracing the Solent, Southampton Water, Chichester Harbour and the rest, especially in sunny weather; but the landmarks Humphry Dimock pointed out to me from the T-21 were hardly visible through drizzle under a low overcast.

The Navy first became glider-conscious in 1947 when Lieut. Cdr. John Sproule took a "circus" round the air stations, and he became first secretary of the R.N. Gliding and Soaring Association. He recently left the Navy but still lives at Shoreham, where he keeps his home-made ultra-light autogyro.

The basis of this is the Bensen "Gyro-Glider" which is really a gyro-kite, since it can only become airborne on tow. But Sproule has added a 70-h.p. motor with propeller, and we took it along to Tangmere on Apr. 29, by kind permission of the C.O. there. It had its best day's flying yet, until finally the engine cut suddenly, and in the ensuing landing, due to insufficient rotor speed, several metal tubes were bent. Rather than straighten them out, Sproule will probably build a more conventional aircraft round the engine, which, like him, remained intact.

There are more gyro-gliders in the United States than there are sailplanes, but their total flying hours are unlikely to be worth estimating.

* * *

"FOR a number of years I have enjoyed Gliding Notes," writes H. Marshall Claybourn, president of Kansas Soaring Association, and in appreciation he sends the last two newsletters of his Association, which has been chosen to organize this year's U.S. National Soaring Championships. They are to be held from Aug. 1 to 10 at Wichita, just south of lat. 38°, between 1,000 and 2,000 ft. a.s.l. where the ground has already begun to rise towards the Rockies, whose summit ridge is 450 miles farther west.

Harland Ross, co-designer of the RJ-5 which still holds the World's distance record of 535 miles, is hard at work converting its successor, the R-6, to a single-seater and hotting it up for the U.S. Nationals. As a two-seater he won three World's records with it for speed round the three sizes of triangle in three successive days.

* * *

AFTER the non-soaring Easter rally at Swanton Morley in Norfolk, Peter Scott left his Olympia 419 there in the hope of the spring north-easterlies eventually blowing in. The latest club newsletter relates that on Apr. 7 he and Alfred Warminger set off westwards, but he could get no farther than Peakirk in the Soke of Peterborough, 52 miles, while Warminger managed 38 miles. There was a light easterly wind after the passage of a cold front from the north, according to the weather chart.

A RUSSIAN book called "Planeri" has kindly been obtained for me by Beverley Shenstone. It contains three-view drawings and descriptions of 92 of the World's sailplanes, taken from 28 journals including "Sailplane and Glieder" [sic] and other sources. Eight British types are included: transliterated, they are: Eton (a primary), Prefekt, Sedburg, Kirbi Kadet, Tutor and T-31, Olimpia Eon, Skai, Skailark, and Egl. But no Russian types are shown.

* * *

NEW Canadian national altitude records were set up in the "Rocky Mountain wave" during an Easter meeting at Pincher Creek, 55 miles W.S.W. of Lethbridge and 12 miles E.N.E. of the summit line of the nearest mountain range, which the atlas shows to be between 7,000 and 9,000 ft. high throughout its length.

J. J. Audette, of Regina, reached 31,250 ft., and his gain of height, 24,000 ft., equalled that set up by Ralph White at the same place a year before. Kurt Weiss, of Calgary, with Art Penz as passenger, reached 24,000 ft. in a two-seater. Eleven gliders competed. Weather charts show the only wind of any magnitude to have been a westerly one on Apr. 2, set up by a depression passing to the north.

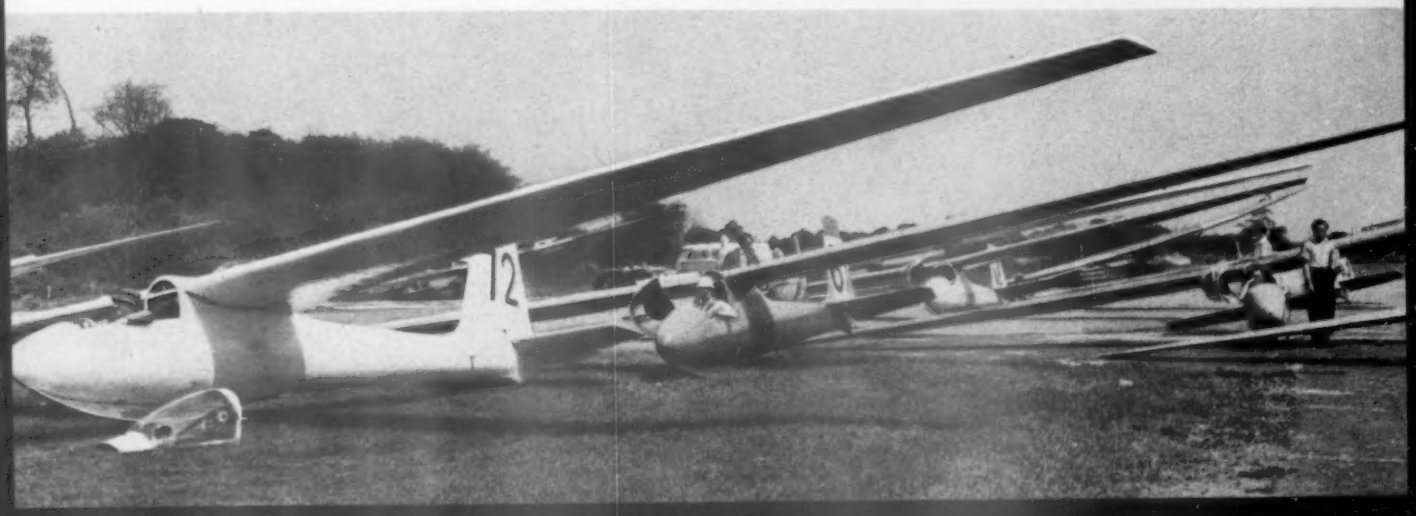
* * *

DISTANCE flights for the Silver "C" (50 km.) were made in Poland *avant cette guerre* in S.G. gliders with a gliding angle of 1 in 8 and a sink of 1.70 m/sec., according to Raymond Sirretta, editor of *Aviasport*. This must refer to the SG-38 open primary glider, but I don't recollect ever seeing the news in print before.

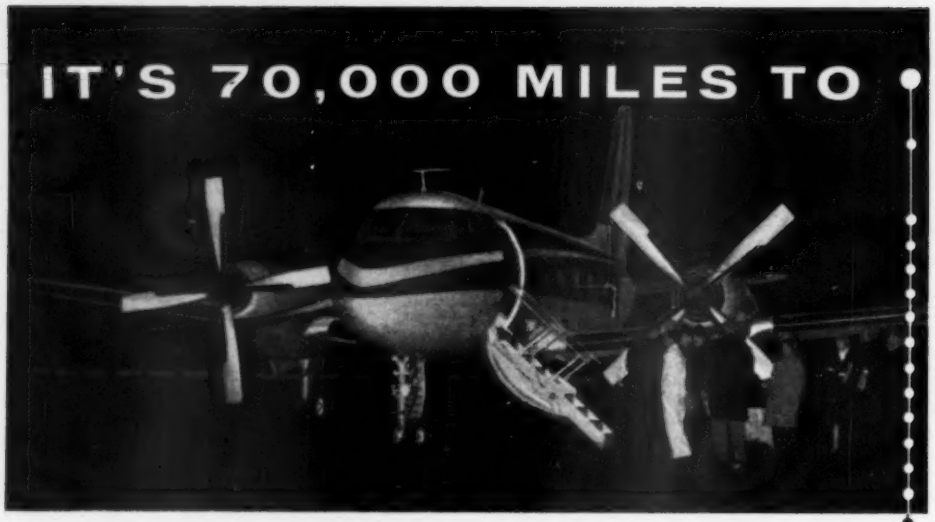
There is no doubt that the feat is possible. On Jly. 25, 1948, Sgt. Edgar Basham was winched at Oerlinghausen to 800 ft. in an open primary SG-38, caught a thermal, and then another one, entirely by "feel" (he had no variometer), and rose to 4,200 ft. Cloud base was only about 1,000 ft. higher, so he could probably have gone off on cloud currents, though actually he landed back at Oerlinghausen.

M. Sirretta quoted the Polish flights as showing that Poland has better soaring conditions than France, and suggests that this is why 56 Polish sailplane pilots have earned all three Diamonds, compared with a mere 54 pilots in France.

Contestants for the National Gliding Championships waiting at Lasham.



IT'S 70,000 MILES TO PARIS



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Two short months ago Grumman Gulfstream N358AA left Wilmington, Delaware; 70,000 miles and 200 flying hours later it touched down in Paris for the Aero Show, having demonstrated its abilities to enthusiastic executives in more than 20 countries.
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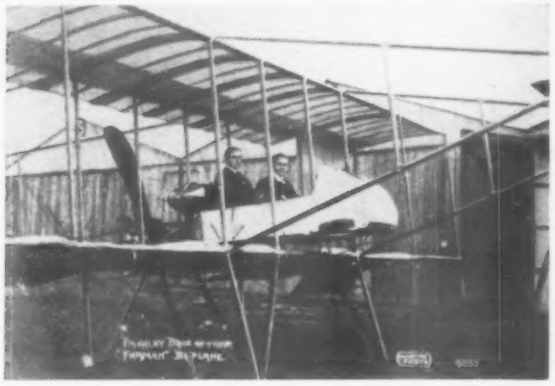
Correspondence

Landings—The Mostest

THE recognition of Cecil Pashley's unique career in aviation by the Award of Merit conferred on him last week by the Guild of Air Pilots and Air Navigators will be welcomed by the many generations of "Pash's" former pupils all over the world. It is nice to think that "Pash" is still instructing on the very



Cecil Pashley with his brother on their Farman Biplane.

spot where he and his brother had a school of flying 50 years ago.

Cecil Pashley's 18,000-odd hours have been done in instructing, joy-riding and test flying and do not include any airline or charter work. I agree with your statement last week that there can be little doubt, therefore, that "Pash" has done a greater number of take-offs and landings than any man in the history of flying; and it is most unlikely that this record will ever be equalled.

Cheltenham. DON BROWN.

First (Squadron) Monoplane?

REFERRING to your notes on the 25th birthday of the much loved Avro Anson (p. 257, March 10 issue) I do not think your contributor, "R.S.H.," is strictly correct when he claims that the Anson (which was first operated by No. 48 Squadron) . . . *was the only monoplane in Squadron service with the R.A.F. at that time.* Was not No. 38 Squadron with its Fairey Hendon IIs (two Rolls-Royce Kestrels) equipped with these "heavies" (AUW 20,000 lb.) before No. 48 Squadron received its Anson Is? Considering the original Hendon Mk. I prototype (two Bristol Jupiters) first flew in 1930 (it was not successful and never got beyond the prototype), I should think it's reasonable to assume that the Hendon Mk. II prototype made its first flight in 1932-33 and that production Mk. IIs were built and delivered to No. 38 Squdron by 1935.

According to data I have, one flight of No. 38 Squadron was later detached to form No. 115 Squadron.

Kenya, East Africa. DENNIS M. POWELL.

[According to the Air Ministry No. 38 Squadron received Fairey Hendon IIs in November, 1936, and flew this type until the end of 1938. The squadron received its first Wellington on Nov. 24, 1938, and was completely re-equipped with this type by June, 1939. So R.S.H. seems to be right.—ED.]

Remembrance Week at St. Clement Danes

I DO not know whose idea it was to arrange this special week of remembrance but the thanks of all who attended one of the services should go to him (or her!). Perhaps owing to lack of publicity in advance (many people require fairly long warning if they live some distance from London) the congregation for the 15.30 hrs. service on Tuesday, May 9, was only about 60—almost equally divided between civilians and members of the R.A.F. (seemingly all officers or warrant officers; I didn't see a single person under W/O rank except those on official duty).

Assuming this is to be an annual event—as indeed it should be—"long-range" publicity would enable organizers of squadron reunions to fix their gatherings for the evenings of the Week of Remembrance, to give those who so desire an opportunity to attend one of the services or, at any event, to visit St. Clement Danes for the purpose of examining the special books, the badges let into the floor, and the beautiful interior of this R.A.F. church.

As always when I enter church, I looked at the hymn-board for the numbers, hoping they'd coincide with squadrons I knew. Happily the Psalms were Nos. 47, 48 and 49 (World War I, later Bomber and Transport Command) and the hymns Nos. 486 (New Zealand anti-Buzz Bomb Tempests) and 201 (Shackletons). Seeing those numbers brought back many memories which, surely, is the purpose of this week of one-hour services. For the singing of the choir alone it is worth while making the effort.

Just one criticism. Impressed as I was with the smart change-over of the airmen acting as "guardians" of the Books of Remembrance, it was extremely distracting to have them coming in *three times* during the service, once during the anthem "I know that my Redeemer liveth," which was unforgettably performed by a brilliant solo voice. If the airmen cannot stand for an hour then let the changes take place during congregational hymns.

Leigh-on-Sea, Essex. L.H.

Groundabout

Success! So Boeing have at last heeded the hints so heavily dropped here from time to time and have scrubbed the repulsive word "Airplane" from their title. Not that they *admit* our influence, of course—*they* say something about "recognition of the Company's diverse areas of effort." However, our triumph is not quite complete. The citizens of Renton, where Boeing have their huge airliner plant (*English*: Factory), have flatly refused to insert a silent W in front of the town's name. This, I submit, is tantamount to saying that the Wrights were wrong. I wrest my case.

*

Life among the Anthropoids. A space monkey was complaining bitterly to another monkey, not in the aviation business, of the ardours of being fired off, experiencing weightlessness and re-entry and then being fished out of the sea. When his friend suggested that he quit his astronautical career, he replied, "What, and go back to cancer research?"

*

Definitive Function

"Heathrow? Isn't that the place that started out as an airport and ended up as the world's most expensive car park?"

*

Chip off the old 'Bok. Most fathers — those who've done well at an interesting job, anyway —hope their sons will follow the paternal pattern. So Capt. Graham Bellin, who retired to his South African farm in 1946 after 19,000 hrs. flying with Imperial Airways, B.O.A.C., and Union Airways, S.A., must be delighted with his son Pat's aviating spirit. Denied R.A.F. flying, on medical grounds, he joined for a ground job and did his flying privately. Now, with 400 hours flying to sustain him, he's trying to fly his Tiger Moth home in seven days to establish a class record. If he got there last Sunday, as planned, I bet Dad was there to meet him.

*

Line Shot

Air Traffic Control to pilot heading for their airfield: "What is your position and ETA?"

Pilot: "Er, 18 miles north-east of the field, ETA 1620."

A.T.C.: "We make you 27 miles due south. What is your ETA now?"

Contemplative pause, then—

Pilot: "That's a good question."

by Lorenz

Industry Record

Starter Sales

Since the establishment of its aircraft equipment division last November, Auto Diesels, Ltd., of Uxbridge, has received orders worth approximately £110,000 for ground starting equipment. These have come from airline operators and aircraft manufacturers and have been for both diesel-electric units and gas-turbine air starters.

Flight Analysis on Film

The ability of the Fairchild photographic flight analyser to record photographically on a single strip the trajectory of a moving object was illustrated at the College of Aeronautics, Cranfield, on May 16, at a demonstration organized by Aveley Electric, Ltd., of South Ockendon, Essex. This was the first showing of the analyser outside the U.S. where it has been in use for the past three years. The industrial products division of the Fairchild Camera and Instrument Corpn. are responsible for its manufacture.

Operation is simple. The operator tracks an aircraft manually with the aid of fixed binoculars keeping an aperture aligned with it. The automatic triggering and actuation of the shutter exposes a sensitized plate producing a series of adjacent pictures. In all 58 images of the aircraft appear equally spaced along the trajectory. As the position of the subject is recorded, so the instantaneous time of exposure is marked on the base of each strip. The analyser record is thus a true, undistorted graph, self-plotted by the aircraft at a constant scale, showing attitude, position and relative time.

The analyser is completely portable and is independent of power lines, working off a dry-cell pack of six 6v. batteries. It can be permanently sited if required.

A New Baggage Loader

With the growing intensity of traffic at airports a particularly pressing problem is the quick and efficient handling of baggage and light freight. Details of an interesting adaptation of the well-known Land-Rover designed specifically to meet this problem have been sent to us by Mr. P. C. D. Moy.

Basically the unit, known as SPABLE (self-propelled aircraft baggage loading equipment), consists of an all-steel flat belt conveyor mounted on a standard 88-in. Series II chassis. The conveyor, built by Precision Engineering Products (Suffolk), Ltd., of Bury St. Edmunds, is 19 ft. long between terminal drum centres when both sections are operated in the same plane. The steering wheel in the driving compartment has been offset to allow the front boom of this to be lowered almost to the level of the vehicle's bonnet.

A total distributed load of 896 lb., or unit loads not exceeding 224 lb., can be handled by the conveyor. Speeds of the 22-in. wide endless belt may be varied between 15 and 90 ft. per min. and the belt may be operated in either direction.

During operation the rear feed-on (or discharge) height of the conveyor boom is hydraulically adjusted between 1 ft. 2 in. and 4 ft. 8 in. Similarly, front feed-on (or discharge) height can be between 4 ft. 8 in. and 13 ft. 6 in. The conveyor may be operated with the two sections of the boom at any angle to one another within these height limits.

Gross weight of the vehicle is just under 2¼ tons—the conveyor accounting for 1,792 lb. of this. By removing six bolts and disconnecting two self-sealing hose couplings the conveyor can be speedily dismantled leaving the Land-Rover available for other tasks. Overall dimensions of the unit are height 5 ft., width 6 ft. 1 in., length 18 ft. 10 in. The low overall height makes it suitable for under-belly work with most modern commercial transports.

A similar conversion has been done to the 109-in. long-wheelbase Land-Rover giving a conveyor length of 22 ft. Boom height with this version varies between 2 ft. 2 in. and 6 ft. 11 in. for rear feed-on and 6 ft. 11 in. to 16 ft. 2 in. for front feed-on.

A special all-steel trailer for use with both these loaders has also been developed. It has a capacity of 250 cu. ft. or 2,582 lb.

A demonstration of SPABLE at London Airport with a B.E.A. Viscount.

Representation in France

Société Anonyme des Etablissements Ed. Jaeger, of Paris is to act as sole representatives of Smiths Aircraft Instruments, Ltd., in metropolitan France. A recently concluded agreement between the two companies covers the sales and service of the complete range of Smiths aviation instruments and equipment, including the products of its associates, Kelvin and Hughes (Aviation), Ltd., and Waymouth Gauges and Instruments, Ltd. Exceptions are spark plugs, igniters and jet-pipe temperature measuring equipment which will continue to be handled by K.L.G. Société Anonyme.

The Jaeger concern is exhibiting at the Paris Salon and will be showing one of the Kelvin Hughes air data computers which it will be building under licence.

Name Change

Avdel, Ltd., is the new style of Aviation Developments, Ltd., of Welwyn Garden City, Herts. The company's telephone number is now Welwyn Garden 28161.

Aviation Calendar

May 25

Paris.—24th International Aero Show; until Jne. 4.

May 27

Liège-Bierset.—Belgium Aero Club and ANCUPA Rally; until May 28.

May 31

Le Bourget.—International Grand Prix for Helicopters of the French Aero Club.

Jne. 2

London.—R.Ae.S. Rotorcraft Section lecture, "Development of Stabilizing Equipment for Helicopters," by P. D. MacMahon, in the Lecture Theatre, 4 Hamilton Place, W.1, at 18.00 hrs.

Panshanger-Rhoose.—London to Cardiff Air Race and National Air Race heats at Cardiff; until Jne. 3.

Jne. 3

Coulommiers.—Coulommiers Aviation Circle First Brie Rally; until Jne. 4.

Company Notices

NEW COMPANIES

Terry Tozer, Ltd. (689,861).—Private co. Reg. Apr. 14. Cap. £100 in £1 shrs. To establish, maintain and operate shipping, air transport and road transport services. Sec.: Dorothy M. Graeme.

T.T. Aviation Engineering, Ltd. (690,887).—Private co. Reg. Apr. 26. Cap. £5,000 in £1 shrs. Sec.: A. D. Barritt. Reg. off.: 18 Westmorland Road, Newcastle upon Tyne, 1.

Simon Green, Ltd. (690,628).—Private co. Reg. Apr. 24. Cap. £100 in £1 shrs. To carry on the business of manufacturers, reconditioners and repairers of jet and turbine engines, internal combustion engines. Sec.: Hilary Jobson. Reg. off.: 113 High Holborn, W.C.1.

Nas Airport Services, Ltd. (691,049).—Private co. Reg. Apr. 28. Cap. £10,000 in £1 shrs. To carry on the business of wholesale and retail caterers, to provide catering services for aeroplanes, aerodromes, airports, heliports, railways and ships. Sols.: Clifford-Turner and Co., 11 Old Jewry, E.C.2. Reg. off.: 4 Farley Court, Melbury Road, W.14.

INCREASE OF CAPITAL

Rent-a-Plane, Ltd. (658,742).—Aircraft owners, etc., 40-42 Copthall Avenue, E.C.2. Increased on Aug. 11, 1960, by £1,000 in £1 ordinary shrs., beyond the reg. cap. of £1,000.

New Patents

APPLICATIONS ACCEPTED

871,587.—**D. Napier and Son, Ltd.**—"Helicopter propulsion systems." Aug. 28, 1959. (Aug. 29, 1958.) (Addition to 847,521.)

871,712.—**Sud-Aviation Soc. Nationale de Constructions Aeronautiques.**—"Power propelled vehicles or guided missile." Jly. 7, 1955. (Jly. 9, 1954.)

871,713.—**Sud-Aviation Soc. Nationale de Constructions Aeronautiques.** — "Aerodynes." Nov. 8, 1955. (Nov. 19, 1954.)

871,470.—**Fairey Co., Ltd.**—"Aircraft incorporating vertical thrust generators." Sept. 19, 1957. (Sept. 20, 1956.)

871,625.—**Parsons Corporation.**—"Rotor blade structure and method of moulding same." Nov. 13, 1957. (Nov. 13, 1956.)

Printed specifications of the above will be available on Jne. 28, 1961, and the opposition period will expire on Sept. 28, 1961.

Personal Notices

BIRTHS

Beill.—On May 9, at R.A.F. Hospital, Aden, to Vyvian, wife of Flt Lt. A. Beill—a daughter.

Burton.—On May 8, at Headington, Oxford, to Diana (*née* Lewis), wife of Flt. Lt. D. E. Burton—a daughter.

Emanuel.—On May 11, at Redruth Hospital, to Patricia, wife of Flg. Off. M. Emanuel—a daughter.

Harris.—On May 10, at R.A.F. Hospital, Akrotiri, to Janet (*née* Shore), wife of Flg. Off. M. Harris—a daughter.

Hodson.—On May 11, at Romford, to Eileen, wife of Sqn. Ldr. D. G. Hodgson—a son.

Lake.—On May 6, at Aldershot, to Pam, wife of Sqn. Ldr. P. E. Lake—a son.

Oliver.—On May 12, to Mary (*née* Traill), wife of Sqn. Ldr. A. V. W. Oliver—a son.

Perrin.—On May 2, at Leamington Spa, to Norma (*née* Taylor), wife of Sqn. Ldr. D. R. Perrin—a daughter.

Simpson.—On May 9, at King's College Hospital, to Pat, wife of Sqn. Ldr. K. W. Simpson—a daughter.

DEATH

O'Donnell.—On May 10, Wg. Cdr. Rudolph Peter O'Donnell, M.V.O., O.B.E., Hon. R.A.M., late Organizing Director of Music, R.A.F.

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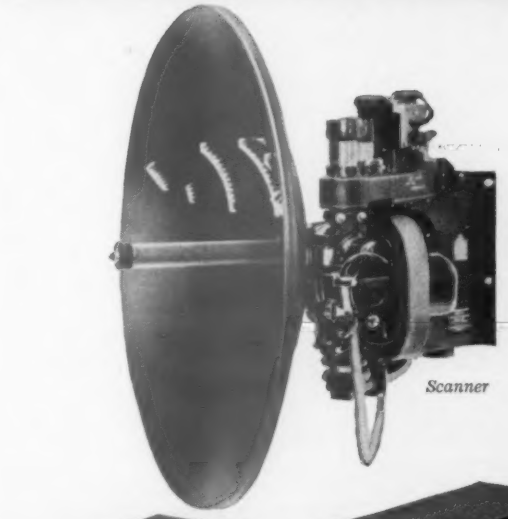
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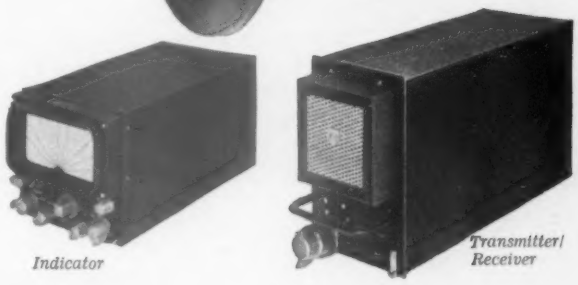
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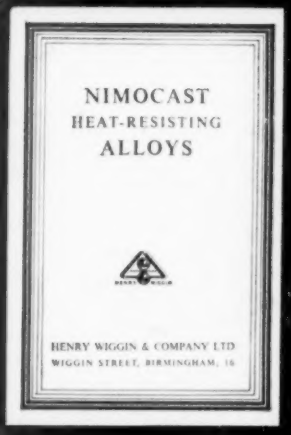

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